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BONUS: 1978 vacation driving tips

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APRIL 2-29, 1978

Table Saw comes partially assembled.

On sale at most Sears retail stores.
Prices and dates may vary in Alaska and Hawaii.

Now you can get Sears
Best 10-inch Table Saw
Outfit, at \$100 off. The
outfit that includes:

- A steel leg set with firm, stable footing
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- And that's not all. You also get Sears exclusive Exact-I-Cut. The feature that shows you where the wood will meet the blade, reducing trial and error cutting. A 24-inch rip capacity that's big enough to handle 4' x 8' sheets of plywood. A see-through blade guard. A self-aligning rip fence and a miter gauge with positive stops at 45° and 90°. Not to mention, Sears convenient credit plans.

FULL ONE YEAR WARRANTY.

If within 1 year from date of purchase this Craftsman table saw fails due to defect in material or workmanship, contact Sears and Sears will repair it free of charge.

Get Sears Best 10-inch Table Saw at \$100 off, while this offer lasts.



Tools that have earned the right to wear the name.

Popular Mechanics®

On the cover

The passengers are dummies—but the plane isn't. What you see is the actual crash of a real aircraft engineered by NASA in a dramatic program to test safety measures that could spare your life in a crackup. For a report on the startling discoveries being made, see page 83.



APRIL 1978

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SOME OF THE NEW COMPACT, AUTOMATIC CAMERAS SEEM VERY EASY TO USE. UNTIL YOU START USING THEM.

There's more to an easy-to-use camera than automatic exposure. Yet that's what most of the new 35mm reflex cameras are: automatic, but hard to use.

Here's why the Minolta XG-7 makes fine photography both automatic *and* easy.

It's easy to take perfectly exposed pictures. Just point, focus and shoot. The electronic shutter in the XG-7 sets itself automatically up to 1/1000th of a second.

But it's hard to take an over-exposed picture. On automatic operation, the shutter locks to prevent over-exposures. It also locks when your batteries are too weak.

Easy focusing. The XG-7's viewfinder is big and bright, even in the corners. Your subject snaps into critical sharpness.

It's easy to be creative. You can make the automatic exposure setting brighter or darker for creative effects.

An easy-to-understand electronic viewfinder. Light emitting diodes tell how the XG-7 is setting itself and warn against under- or over-exposure.

An easy-to-see electronic self-timer. The self-timer lets you get into your own pictures. It's a large flashing light mounted on the front of the camera. The flashing speeds up to let you know when the picture is about to be taken.



continuously with the winder. This exclusive feature allows you to take a sequence of up to 36 flash pictures.

An easier-to-use auto winder. It automatically advances film, as fast as two pictures a second. You attach the optional Auto Winder G without having to remove (or lose) any caps from the XG-7.

The easier-to-be-creative flash. The optional Minolta Auto Electroflash 200X synchronizes continuously with the winder. This exclusive feature allows you to take a sequence of up to 36 flash pictures.

The important "little" extras. The XG-7 has a window that shows when film is advancing properly. A memo holder holds the end of a film box as a reminder. There's even an optional remote control cord.

Fast, easy handling. The way a camera feels has a lot to do with how easy it is to use. Is it comfortable or awkward? Are the controls placed where your fingers naturally fall, or are they cramped together? The Minolta XG-7 is human engineered for comfort and smooth handling. It's quiet, with a solid feeling you find only in much more expensive equipment.

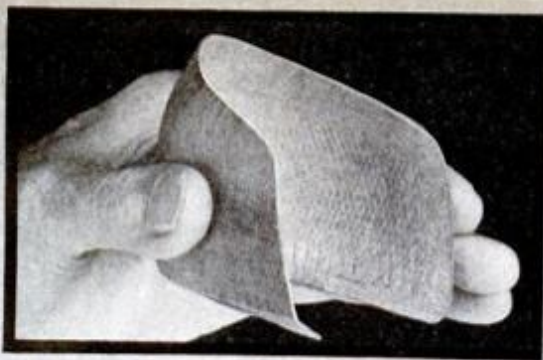
Easy-to-change lenses. Remove or attach lenses with less than a quarter turn. And a system of almost 40 different lenses, from fisheye to super-telephoto, makes the XG-7 a key to virtually unlimited creativity.

Try the Minolta XG-7. See it for yourself at your nearest photo dealer, or write for literature to Minolta Corporation, 101 Williams Drive, Ramsey, N.J. 07446. In Canada: Minolta Camera (Canada) Inc., Ontario.



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Your Red Wing dealer can fit you professionally — with a plain or safety toe — from a wide range of sizes and widths. Find him in the yellow pages, under "Shoes".

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Red Wing 1155



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LETTERS TO THE EDITOR

Flak from the field

I enjoy PM as a source of information on both practical and simply interesting subjects. Next time you do an article on weapons, however, get someone who knows something about them, not a greenhorn who's been sold a bill of goods by an Army PR type. I'm referring to Mort Schultz's article, *The Modern GI Joe: You've Come a Long Way, Buddy* (page 77, Dec. '77).

The .30-cal. M1 has an effective range of over 1000 yards in the hands of a trained marksman. The .30-cal. (7.62-mm) round, at 300 yards, has nearly four times the energy (foot-pounds) of the 5.56-mm M16A1 round. The M16 round is light and has high velocity. Beyond 200 yards it begins to tumble, with consequent loss of accuracy. The only advantage of the M16 is its high rate of fire, which suits it to close-range fire on large numbers of enemy troops.

E.R. BLADES
SANTA MARIA, CALIF.

The effective range of the M1 is considered to be 500 yards, not 300. The effective range of the 5.56-mm M16A1 is 220 meters (240 yards), and this is due to the inherent inaccuracy of the short barrel and the light (55-grain) bullet. Beyond 200 yards, it has a hard time maintaining ballistic stability and trajectory.

F.J. BARRESI
WOODHAVEN, N.Y.

I am currently a National Guardsman and previously served with the Marine Corps. I am also an avid hunter and target shooter.

I agree with Mr. Schultz that the M16 is superior to the old M1. It's lighter, fires faster and, most importantly, the ammunition is lighter; more rounds can be carried by an individual soldier in the field.

I must disagree, however, with some of Mr. Schultz's other statements. I believe the M1 to be more accurate at long distances than the M16. The heavier bullet of the M1 retains its velocity, shocking power and accuracy. The smaller round is more likely to be deflected by brush.

ROBERT J. SCHMIDT
WALTON, N.Y.

Author Mort Schultz tells us he's still suffering from combat fatigue as a result of the bombardment of mail from gun-savvy readers. It would seem that experience in the field doesn't necessarily match official Army data—and that even simple statements about guns can be mighty controversial. (Note that in two of the letters printed here one reader puts the effective range of the M1 at more than 1000 yards, while another claims 500—that's a 100-percent disparity right there.) Incidentally, Mort was a combat soldier during the Korean Conflict.

A 'vial' solution

I was all set to make the multi-use handsaw described in *Two Tools You Can Make from Scrap Materials* (page 99, Jan. '78). However, the source listed for level vials does not carry them. Where can I get the levels?

AL KANSHEE
MILWAUKEE, WIS.

This time we'll really level with you. The vials are manufactured by Stanley Tools and packaged individually as a vial replacement kit (No. 42-701). They cost about \$1.25 per vial at your hardware store or send a check to: Stanley Tools, Repair Dept., 600 Myrtle St., New Britain, Conn. 06050.

How to squeeze lemons

I enjoyed reading your excellent article, *Got a Lemon? Here's How to Get the Drop on Detroit* (page 84, Jan. '78). An additional source of information is Dissatisfied Peugeot Owners of America, 45 Main St., Tarrytown, N.Y. 10591. Besides compiling data from other disenchanted owners of the French-made diesel, they make available two very helpful books of general interest: *Lemon-Aid* by Phil Edmonston, \$4.95, and *Down Easter's Lemon Guide* by the Maine State Bureau of Consumer Protection, \$1.00. Both books are well worth the investment.

DENNIS KAYE
INDIALANTIC, FLA.

Big interest in buses

May I offer my congratulations on the article on bus conversions (*Outgrown Your Motor Home? Take the* (Please turn to page 234)

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IT'S NEW NOW



Homebuilt plane with a prop in the middle

A 130-hp Mazda rotary engine, located just behind the pilot, drives a shrouded prop in this unusual Ric-Jet built by George Richter of Los Angeles. The power-enhancing ducted-fan effect produces speeds up to 200 mph. Length is 22 feet; wingspan, 18.



Multipurpose power mower

The 22-inch self-propelled Maxi-Mow combines mowing, cleaning and bagging into one operation. At \$338, the Sears Craftsman mower features five speeds, 4-hp engine and variable cutting heights.

Do drink the water

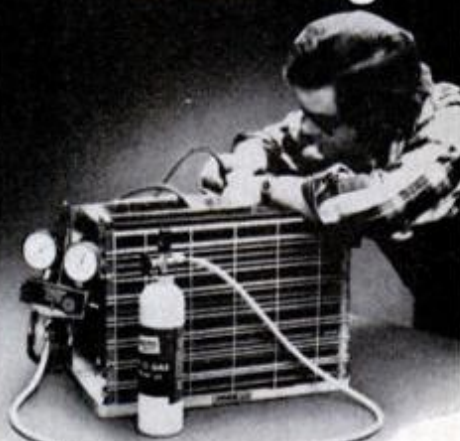
Travelers and campers can drink more safely with this Walbro Water Purifier. Pour in water and a chemical kills virtually all harmful bacteria in at least 100 gallons, the maker claims. Price, \$25. Walbro Corp., Cass City, Mich. 48726.



'Credit-card' calculator

The LC-78 Mini Card four-function calculator is about the size of a standard credit card and only 1/8 inch thick. It has a three-key memory and seven-function percent key that can calculate discounts, markups and the like. About \$30 from Casio, 15 Gardner Rd., Fairfield, N.J. 07006.

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If you think you can't learn TV and audio servicing at home, I say, "BALONEY!"

Maybe you don't believe that we can actually teach you to service TV and audio equipment by mail.

Yet here at NRI, we're doing it every day. Helping people to bigger and brighter futures. Let me tell you why the NRI way works so well... and challenge you to put us to the test.

One of the secrets of the success of this school is the fact that its founder, J.E. Smith, was a teacher. So, when he originated his first course in radio over 60 years ago, it was carefully designed with training in mind. And that principle has guided us ever since. In every technical course we offer. Today, every aspect of our courses in TV and audio servicing are student-oriented to make learning as fast and as easy as possible.

Exclusive Training Methods

Right off, that means that you get far more than book learning. NRI gives you practical, hands-on experience as you progress. In our Master Course in TV and audio servicing, you actually construct a 25-inch diagonal solid state color TV. You start right with the basic parts and as you build it, you introduce and correct typical servicing problems, ending up with a complete unit, ready to use. That way, you get the actual bench time and intimate knowledge you need to handle real servicing problems. And before that, you even assemble some of your own electronic test instruments so you not only know how to use them, but how they work. That kind of training sticks with you... gives you extra confidence.

And Mr. Smith taught us something else, too. Not to go too fast. So, our courses have what we call "bite-size" lessons. That's another way of saying that they're easy to digest. Big enough to cover a specific subject thoroughly, but not so much that it'll overwhelm you. Written clearly, without a lot of gobbledegook. And we keep in mind that you're learning at home, so you take our lessons at your own pace. That way, you can learn in your spare time without interfering with your present job or eating up too much of your family life. Of course, if you want to move ahead faster, we're behind you all the way. The point is, it's your choice.

Professional Instructor/Engineers

One of the ways we back you up is with a fully-qualified staff of professional instructor/engineers. They're there to help you when you have a problem with any aspect of your studies... lessons, theory, bench training. And because most of them



John E. Thompson, NRI President

actually helped plan your lessons and designed your equipment, you'll get answers right from the horse's mouth, answers that are clear and to the point.

I might add that these are not a bunch of ivory-tower professor types. In between checking your lessons and giving you personal help, they're busy keeping up with the state of the art, designing new equipment and revising lessons to get you ready to handle even the latest equipment. As a case in point, take the audio equipment we added to our course recently. Not just stereo, but *four-channel*. Maybe a little exotic, but when a servicing problem like this hits your bench, you're ready for it. It's the kind of thinking and planning ahead our founder would have liked.

I Dare You To Do It

Now you might think I'm bragging a little too much on how good NRI is, and maybe I am. I'm mighty proud of our accomplishments. But the proof of the pudding is in the eating... how our training works in preparing people for actual jobs. So I'm inviting you to ask the only people who can give you a totally objective answer, professional TV and audio technicians. And here's my bet. Just look in your yellow pages for a couple of TV repair shops, ask to speak with anyone who actually does the repair work, and ask him what he thinks of NRI. I'll bet he says, "Do it!"

I'm not really sticking my neck out, because I know something you may not. Almost half the TV servicemen working out there have taken home-study courses. And among them, it's NRI more than three to one! Ask the pros on the firing line and three to one they'll recommend NRI to you as their first choice. I'll be happy to send you a copy of the national survey that proves it.

Why do the pros like us? Because NRI works. You take it at home so you don't have to go to classes. You take it in your spare time, so you can hold down your job while you get ready for your step forward. And you take it easy, because our

bite-size lessons make it easier, let you set your own pace.

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And to top it off, NRI's equipment is exclusive. We design most of our own, so it's not somebody else's hobby kit or a stripped-down and mostly assembled commercial unit. It's designed so you really learn as you build, designed to give you lots of honest bench time, designed to give you the satisfaction of finishing up with a fully operable, top-quality unit that's comparable to any commercial set on the market. But you built it... you learned something on it! That's J.E. Smith's philosophy again.

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Send for Free Catalog, No Salesman Will Call

There's lots more to tell about NRI training in TV and audio servicing and other courses, but not much space left to do it. So I'm inviting you to send for our free catalog of electronics courses. It contains a complete description of every course, including each lesson, training kits, and experiments. Full color photos show you exactly what your course will include in the way of test instruments, electronic components, and major kits like the 4-channel audio center and color TV.

No salesman will call on you, either. We don't work that way, never have. Our catalog shows you what we have to offer you, what we can do for you. Look it over, then think about it and make your own decision without outside pressure. J.E. Smith always felt that his best students were the self-motivated ones.

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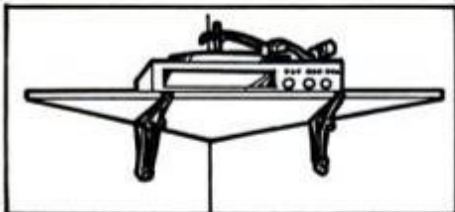
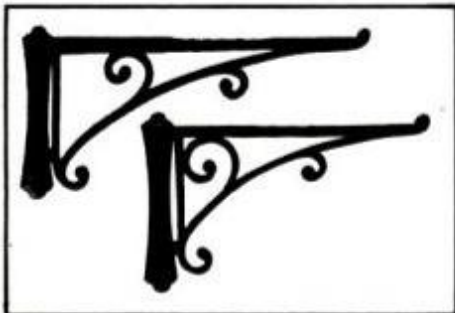
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PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

Versatile shelf bracket

Decorative shelf bracket from Homecraft Div., Gries Reproducer Co., 400 Beechwood Ave., New Rochelle, N.Y. 10802, can lock in any of three positions. The bracket is usable on flat walls, in corners

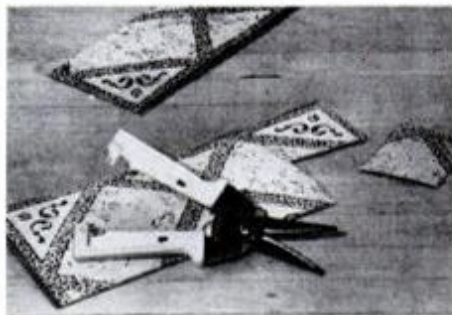


Brackets for 8- or 10-in.-wide stock shelves will hold up to 100 lbs.

and in windows. Made of nonrust, die-cast magnesium, the 8-in. bracket is \$5.; 10-in., \$6.—H.W.

Shear cuts almost anything

The handiest cutting tool to come into my shop in some time is the unlikely looking pair of snips shown at top of the next column. Dubbed Handyshear by Stanley Tools, Dept. PID, Box 1800, New Britain, Conn. 06050, its stainless blades never need sharpening. Mine have cut everything from an old medal to chicken bones. About \$3.69 at hardware stores.—H.W.



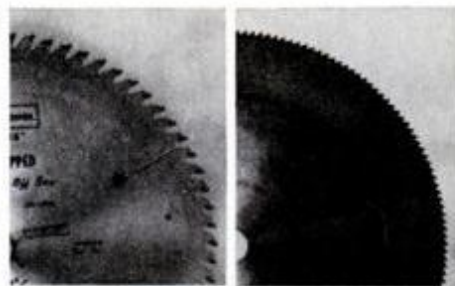
The Handyshear easily handled all test chores from cutting floor tiles (top) to shrubbery pruning (above).

New smooth-cutting carbide blade

The smoothest cut you've ever made with a carbide-tipped blade is possible with Sears' new 72-tooth Krom-edge blade. Designed for use on soft and hard woods, thin aluminum or brass, the blade produced cuts in wood as smooth as the finest blade in my shop. The price is \$49.95, at Sears stores or through the catalog.—H.W.



The 10-in. blade comes in plastic case.



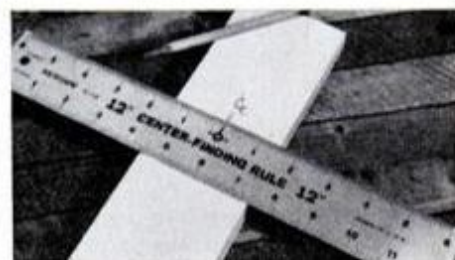
Close-up of blades used for cuts below.



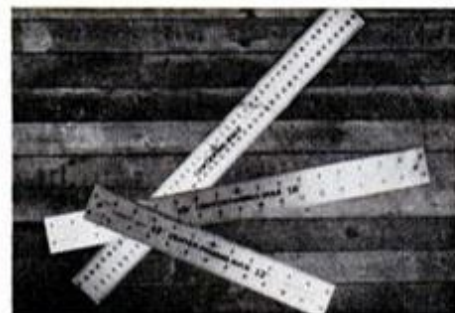
Carbide blade was used for top board.

Center-finding rule

When a center-finding rule appeared (*How to Make Dovetail Joints*, page 102, Aug. '77), many readers wrote and asked where it



Center finding rule ends guesswork.



Several types made include a metric.

could be bought. The answer is at artists' and drafting supplies stores, Fairgate Rule Co., Inc., Cold Spring, N.Y. 10516—H.W.

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

No carburetor. No gasoline. No spark plugs. No tuneups. No foolin'.



So how does it run, you ask?

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above (including Panatela elastic-back slacks, jacket, and vest) costs less than many people spend on a sport-jacket alone.

Then there's the second, sportier look you can have when you buy the hopsack weave coat or the matching bush jacket shown here. Giving you two

completely different looks, for little more than the price of one.

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HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Window condensation

Two of the dozen Thermopane windows we installed about 10 years ago have developed leaks, causing condensation to form. Should we replace or repair them?—Mrs. C.L. Haines, Zirconia, N.C.

The manufacturer of your windows enjoys an excellent reputation for insulating glass. This window is composed of two sheets of glass separated by a sealed air space containing dry air. Obviously, the "seal" is broken, allowing air and humidity to get between the sheets of glass. Your window probably carries a 10-year warranty, but in 10 years much can happen: settlement in your structure causing the frame to go out of square, a minute hole or crack in the glass, and so forth. You should replace the windows since accumulation of moisture will eventually rot out your frames.

Flushing hot water heater

We must have the lower heating element in our 9½-year-old water heater replaced. Our serviceman said that mineral deposits had built up around it, causing it to burn out. He said that draining it occasionally would not free the deposits, although he did scoop out quite a bit. Why not drain occasionally?—M.B. Lorden, Roanoke, Va.

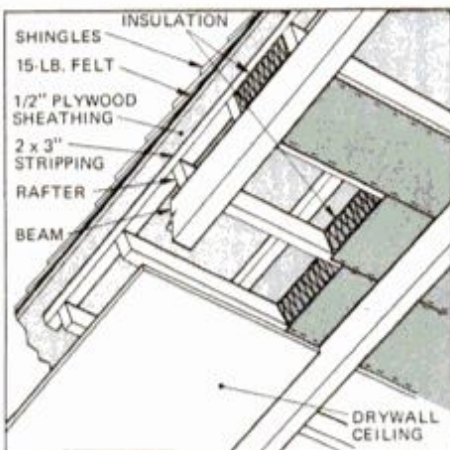
Not only drain your heater occasionally; but flush it out as well. Some manufacturers recommend flushing once a month. Your plumber is right, it will not dislodge buildup of materials (minerals), but it will certainly help to keep them from forming. Of course, once a "roughness" has started, new formations have a surface to cling to. No need to go through the emersion element. Merely hook your garden hose to the drain and let water flow 8 to 10 minutes.

Incidentally, a 10-year contract for \$10 (as you probably have) is a great buy, but it should tell you something about the life expectancy of a water heater. If your utility company will renew your contract for another 10 years, grab it.

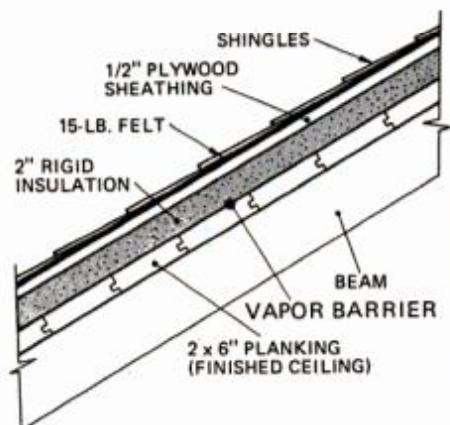
Insulate a bare beam ceiling

We are building a house soon. How do we insulate a roof over an exposed beam ceiling?—C. Cameron, Fayetteville, N.C.

There are several ways to insulate your ceiling. One way uses batt insulation, the other rigid insulation (as shown). For the latter method you can use 2x6-in. (or thicker) V-joint tongue-and-groove decking (in place of the horizontal



Batt insulation with a drywall ceiling.



Rigid insulation used with T&G planking.

rafters) depending on the interior effect desired.

To prevent condensation and resultant staining of the drywall ceiling if batt insulation is used, air must circulate between the top of the insulation and the inside of the roof sheathing. This air should flow from soffit vents, up to the ridge vent (or out the opposite soffit). The best method of getting air

circulation between roof sheathing and top of insulation is "stripping." With rafters nailed to beams, nail 2x3s at right angles to rafters spaced 24 in. on centers. Then nail roof sheathing to the stripping; then felt and shingles. Cut drywall to fit between the beams and nail it to bottom of the rafters. The extra cost of material and labor is worth the assurance that condensation stains won't appear on your ceiling.

Have a licensed engineer or architect determine the spacing requirements and sizes of your beams, rafters and decking.

Accumulation in the chimney

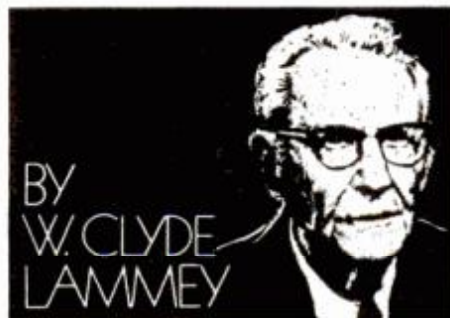
The chimney in my brother's home in North Dakota collects soot about 3 ft. above the kitchen stove flue opening. He burns wood and lignite coal in the stove, which exhausts into the same flue as the basement furnace. The soot is like tar, and is practically closing off the flue. Can we loosen this stuff, and how can we keep it from reappearing?—T. Monson, Rock Castle, Wash.

There are numerous items contributing to your brother's problem. Lignite coal is "next of kin" to wood. Soot isn't obstructing his flue; bister (a tarlike substance) is. Bister collects closest to the fire, and soot gathers farther away in the flue. I suggest a professional chimney builder be called for the following reasons: 1. Most building codes prohibit exhausting two fuels in the same flue. 2. The area of your brother's flue (71.5 sq. in.) must equal the area of your furnace flue plus one-half the area of the second flue. 3. His chimney flue must be 2 ft. higher than his roof ridge or any roof within 10 ft. 4.

He may dislodge flue mortar while trying to loosen the bister, which could create a potential fire hazard.

PM

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.



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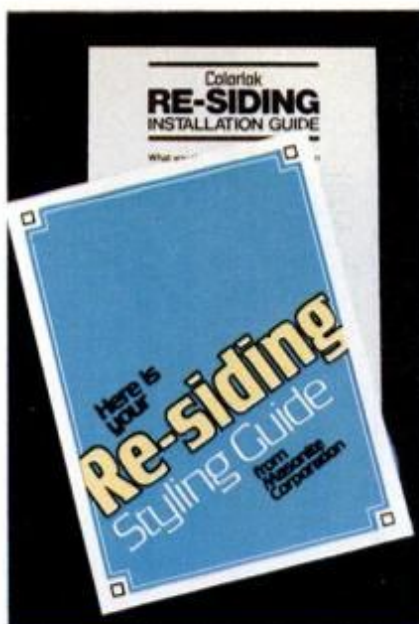
Winston King Winston 100's.

Here's help in choosing and installing the right siding for your home style

Re-siding? Doing it yourself? That investment in time and money calls for a wise decision: which siding style goes with your home to give you exactly the look you want. And how to estimate quantities and install material capably.

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HINTS FROM READERS

Recycled pill bottles



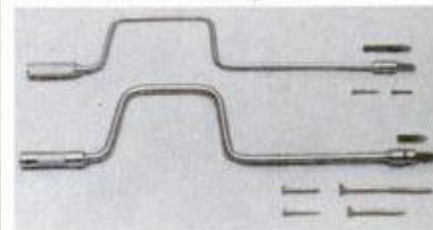
An empty pill bottle with a cup hook screwed into its plastic cap can be hung within easy reach on a rod to hold nuts, bolts and other small parts.—*Grace B. Weinstein*

Inverter powers grass trimmer



To trim grass in areas where no electricity is available, I installed a 200-watt Tripp Lite power inverter on my tractor power mower. It supplies electricity to a 115-volt, 1.5-amp. electric trimmer.—*James M. Buatte Sr.*

Wood screw driving aid



Make quick, easy work of driving wood screws by using a mechanic's speed handle. The 1/4- and 3/8-in.-square drive handles hold special adapters for both slot and Phillips-head hex driver blades.—*Stephen Peterson*

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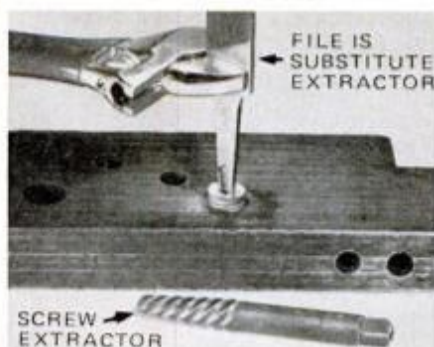
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HINTS FROM READERS

Pinch-hit screw extractor



When you need a screw extractor, substitute an old mill file with its tang ground to fit the screw slot. The flat of the file provides good gripping area for an adjustable wrench.—*John O. Maki*

Cut down on TV glare

Cut down annoying reflections on your TV picture tube by covering it with transparent, self-adhesive vinyl film. Cut the vinyl into three or four strips, each the height of your picture tube by 5 in. wide. Thoroughly clean and dry the tube and affix the vinyl strips to its face. The seams will be inconspicuous when the set is turned on.—*Emanuel Messinger*

Easy-to-make toolholder



Make a toolholder from a section of plastic pipe and a pipe cap glued to one end. Attach it to perforated board with spring clips. Here a ball-top screwdriver is held. Extra bits are in the 35-mm film can.—*E.V. Reyner*

Ice Cold. Without The Ice.

Wherever you go, Gott's patented refreeze bottle eliminates the need for crushed ice. Cold air from the frosty refreeze bottle flows down and through the contents in the bottom of the chest, keeping them cold all day long. So food that looks good enough to eat stays that way. For even longer cold-holding power, use refreeze bottles *plus* ice.



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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

Baby your hands

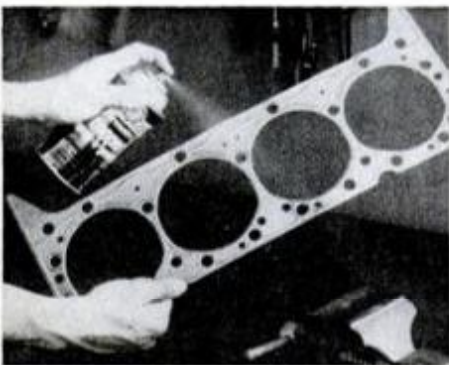
Sometimes hand cleaning after a minor car-care task is harder than the task itself. I've hit the old hands with everything from abrasive powder cleaners that scrub off skin to worthless aerosol glop. What about gloves? Like working with five thumbs. I've settled on lanolin hand cleaners like Lan-Lin. It's smooth and effective, and \$1 a can. Radiator Specialty Co., Charlotte, N.C. 28237—B.H.



Lanolin is Lan-Lin's "secret" ingredient.

Fortified with copper

You don't have to remove your head (or heads) very often, but when you do you want to do it right the first time. So it makes sense to spray copper gaskets before installing and torquing up those bolts. Copper Spray-A-Gasket (\$4 a can) is designed to seal hard-surfaced, non-absorbent gaskets. It helps eliminate hot spots, improves heat transfer and fills pores in the gasket surface. Woodhill Permatex, 18731 Cranwood Parkway, Cleveland, Ohio 44128—B.H.



Gasket spray puts final touch on job.

Chip-proof your paint



Tough, clear skin protects car finish.

If you've got a car body that's designed with lots of tuck-in, tumble-home or whatever behind wheel wells, this transparent skin can protect your finish from sticks and stones thrown up by your tires. Chip/Gard is a 10-mil clear plastic film with its own adhesive. Gravel bounces off without chipping paint, and road tar wipes off with any solvent. It works on other spots exposed to road gravel. To remove, just peel off; it won't hurt the paint. A sheet 12½ in. wide by 12 ft. long is \$15. Carlson Products, 312 S. 3rd St., Minneapolis, Minn. 55415.—B.H.

Basketful of Gunk



Drop parts in basket and let Gunk work.

Gunk. The name is perfect for a product that removes that messy accumulation of oil and grease, laced with road dirt and other debris, from car parts. You need a good solvent and parts-cleaning brush and/or compressed air to remove it. Gunk solvent is not new, but this convenient small-parts kit is. It's \$4.86, with basket. Radiator Specialty Co., Charlotte, N.C. 28237.—B.H.

Mats with class

If you think that automobile floor mats are ugly sheets of rubber, you're not familiar with the coco fiber type. I put them in a Beetle 16 years ago; since then they've become more widely available, and happily so. They're good looking, allow air to circulate to keep your floor dry and remove easily for vacuuming underneath. A good set (\$22 for front or \$32 for front and rear) should last as long as you own your car. Vilem B. Haan, Inc., 11401 West Pico Blvd., West Los Angeles, Calif. 90064—B.H.



Haan coco fiber mats pretty up a Saab.

New car wax

The Car-Plate wax claim to fame is the density of film it lays on a car's finish. That's why it's billed as a "rust resistant auto wax." Released this year by Johnson Wax, Car-Plate (about \$2.50) is supposed to more effectively shut out the two elements that rust your car body—water and oxygen. The relatively porous film provided by conventional wax allows penetration of water molecules, atmospheric gases and industrial fallout. A perfect paint job will, of course, seal a surface, too, but paint on a car picks up chips and scratches sometimes too small to detect. Don't expect Car-Plate to stop rusting from underneath, but for surface rust it's worth a try. S.C. Johnson and Son, Inc., Racine, Wisc. 53403.—B.H.



Car-Plate wax



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them at no charge with any comparably priced shock.

So when it's time for new shocks, pull 'er over at your Monroe dealer. Get a set of Radial-Matics. And from then on, please, take 'er easy.

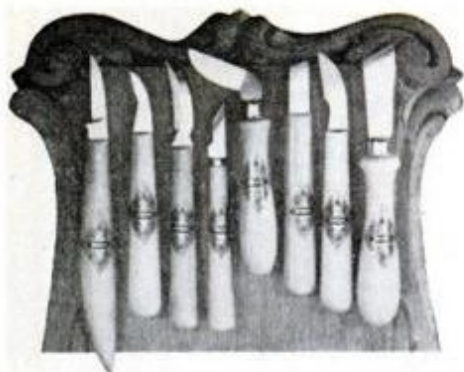
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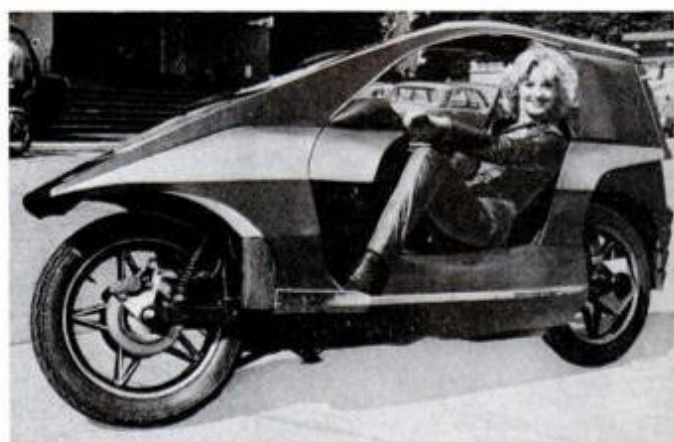
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IT'S NEW NOW

Safe bike— but at a price

Under that slick metal shell lurks the British-made Quasar motorcycle. Designed for safety as well as looks, the tubular steel frame protects rider, and low center of gravity helps resist crosswinds. Powered by an 848-cc, 4-cylinder engine, the Quasar sells for about \$6750 in Britain.



Aims light on work area

Sylvania's new Supertube fluorescent fixture swivels 355° to aim light where it's needed most. Unit costs about \$80, uses 40-watt lamps, comes in single and double-lamp models. It can be wall-mounted.



Charge! But on a skateboard?

Swiss army recruits enjoy this part of training—riding skateboards in combat gear. Using the tricky boards is said to sharpen reflexes and improve balance.



Color kit for darkroom work

If you do color printing, you may find Kodak's new Ektacolor filterfinder kit a help in selecting filters and calculating exposures. The \$20 kit includes filterfinder, color locator, gray test card, calculator dial and instruction booklet.



A little wider, please

No, a tooth-size camera wasn't used to take this unusual picture. The photographer shot through a dummy set of teeth used for demonstrating proper dental care at a U.S. air base clinic in Japan.



"Allstate saved her from being left with no car and still owing the bank \$1100."

"Caroline's car was a total, and she owed more than it was actually worth. Technically, we could have just paid the actual cash value.

"But she would have been left with no car and still owing the bank.

"The best solution in this case was to find Caroline a car that would replace the car she had, and we did.

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DETROIT LISTENING POST

No service with a smile

When PM quizzed the four American auto companies on how close they are to a car that won't require service beyond an oil change during the first year of operation (January DLP), Chrysler said its goal is a car that won't need service for the first 30,000 miles. Ford says that's piker stuff. Ford's goal is to eliminate all service for the first 50,000 miles. The difference may not be as great as it seems. Chrysler is talking short-term and hopes to have its no-maintenance car within the next few years. Ford's prediction is for "sometime in the 1980s."

Pacer to get a Four

The same four-cylinder engine that American Motors is offering as an option on Concord is being tested in Pacer and will likely be extended to Pacer this fall. The Four gives about five more miles to the gallon than the standard Six used in Concord. No difference in price, whether you take the Four or Six.

Another report out of AMC is that the company is back at work on a mini van based on the Pacer body. I'm still on the hook with a prediction of three years ago that AMC will bring out a van, so I hope the grapevine report on the van is true.

VW diesel coming in '79

How come no diesel engine out of Volkswagen's new U.S. assembly plant at Westmoreland, Pa.? Patience, it's in the works. Suppliers working with VW at Westmoreland say a modified, made-in-the-U.S. version of the Rabbit diesel will go in production early next year. Quality control during manufacturing has to be much tighter on a diesel than on a gas engine and VW wants a thorough shakedown at the new plant before the diesel goes into production.

DeLorean planning second car

John Z. DeLorean, the former GM executive who is trying to raise money to build his own car, has plans for a second car if he can get the first one into production. DeLorean figures he needs between \$90 and \$100 million to get rolling on his DMC12 (the initials stand for DeLorean Motor Co.) two-seat

sports job. The car will sell for around \$15,000. There will be a four-seat follow-up car if and when sales of the two-seater reach 25,000 a year.

GM's reading machine

The auto companies compile more statistics than any group outside the federal government. They can tell you what the corn crop was in Nebraska, the birthrate in Vermont and the number of freight cars loaded in Illinois. The companies collect and interpret these mountains of data to help them predict the market for cars.

But there's a danger in placing too much reliance on statistics because the information is stale by the time automakers obtain it. GM has developed a computer program to compensate for this and give up-to-date readings on virtually any subject. The computer reads daily newspapers. It can be programmed to pull out key words or phrases and list the number of times the words appear in the papers. Any words, names or combinations—batteries, baseball, Billy's Beer, hemlines, home mortgages or Panama Canal. If the computer gives a high count on a word of interest to GM, company researchers then go back and read the newspaper stories. The idea is to detect trends before they become trends, potential problems before they become problems and favorable factors GM could use to its advantage to sell cars.

Recalls set record

The car companies did something last year that would seem to be a mathematical impossibility. They recalled more cars to correct defects than they produced. Total sales, including imports, were about 11,200,000 for 1977—yet about 12,500,000 automobiles (again including imports) were called back to correct mistakes. Many recalls, however, were pre-'77 cars—some as far back as 1972.

The 12.5 million callbacks set a record (not including trucks, or the number would be even higher). How can an industry that's always tooting its horn about the quality of its products turn out so many bums? The companies say the record isn't as bad as the recall number indicates. They maintain that only 12

to 15 percent of cars called back actually have to be repaired—a case of sorting through the whole barrel of apples to find the few bad ones.

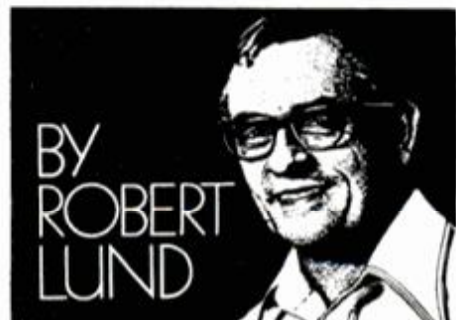
That's fair enough, but there's another side to the story the companies don't like to discuss: Car manufacturers are always looking for ways to cut costs. That doesn't necessarily mean making an inferior, less reliable or less durable product, although that is frequently the net result. The engineer or designer who gets promoted, the supplier who gets the order is often the guy who suggests a way of cutting costs—making it cheaper, eliminating something, omitting a step in the manufacturing process.

In the long run, the price of going cheap isn't always cheap. If there's a recall, the expense of repairing the botched cars can run millions of dollars more than whatever was saved by cutting the cost originally.

This month's freebie

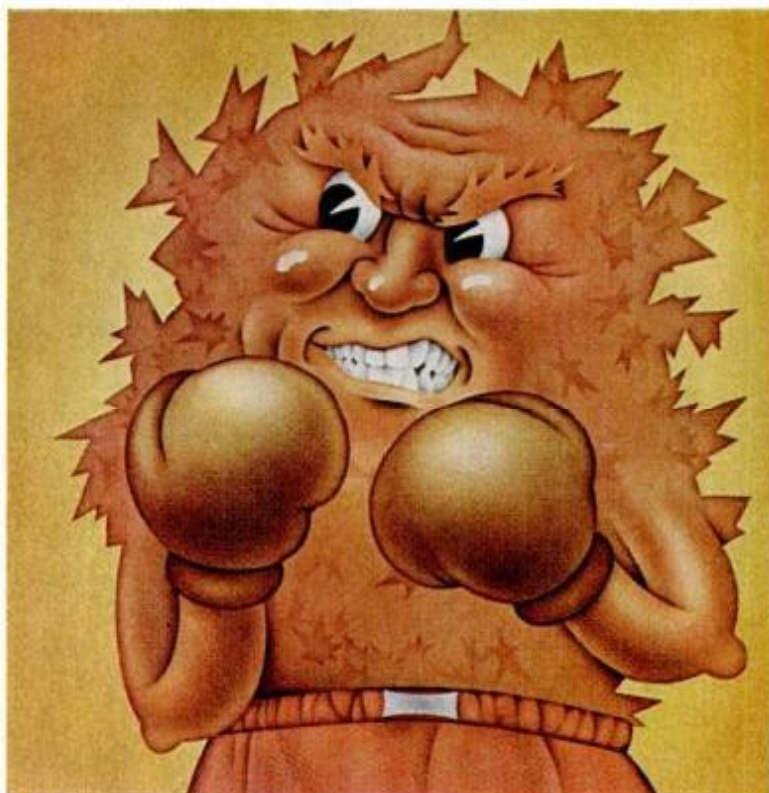
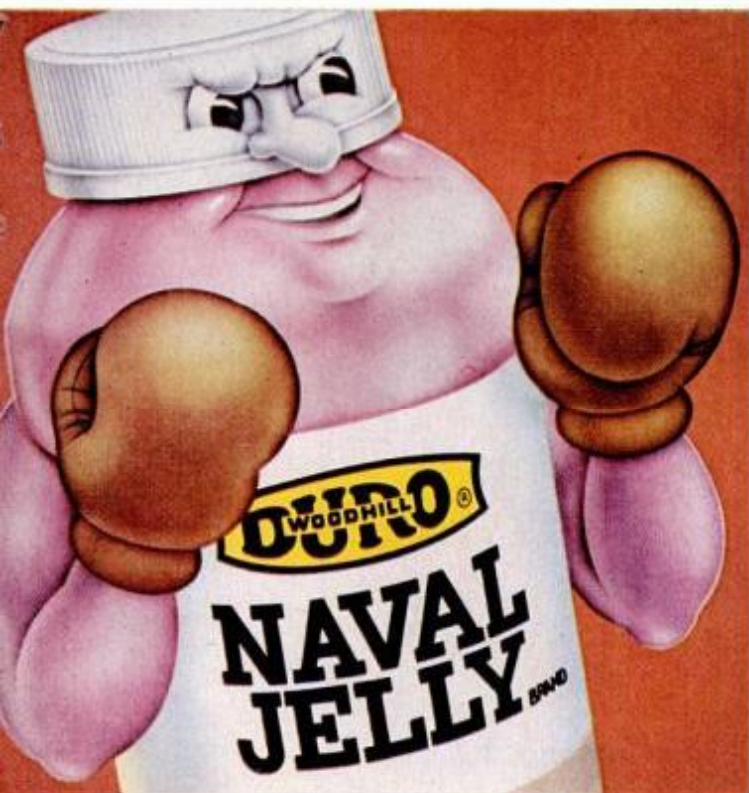
If you want to try your hand at installing new seals and replacing the front wheel bearings on your car, you can get a free how-to book from CR Industries, 900 North State, Elgin, Ill. 60120. Ask for form No. 457809, the seal installation manual.

This company, incidentally, offers the best guarantee I've come across by a manufacturer of replacement parts. If a service shop installs CR seals on a car and the owner beefs about the price or thinks the work wasn't necessary, the shop has CR's permission to refund the customer's money. CR will replace the seals used by the shop at no charge and write the car owner a letter explaining why the new seals were necessary. That's as fair a shake as I've heard of by a parts company. **PM**





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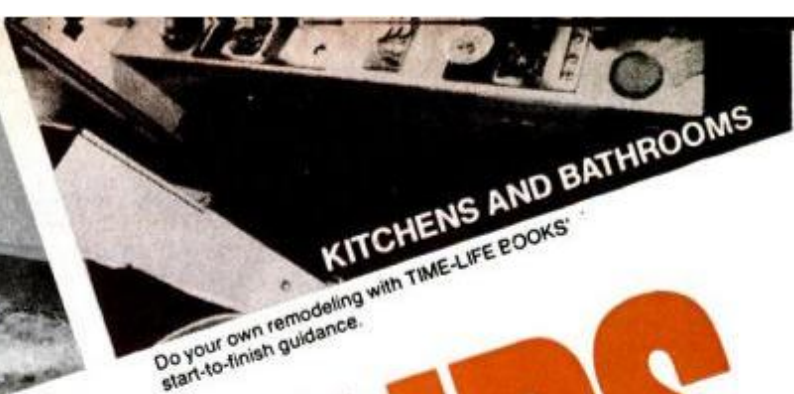
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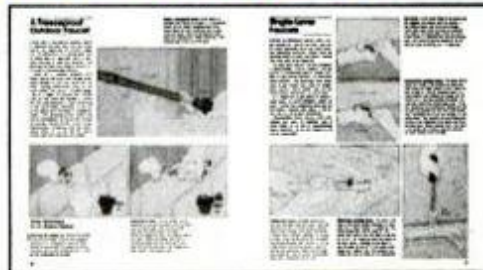
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PM talks with Irv Rybicki, GM's new design chief

'What was right and beautiful yesterday is no longer accepted today'

by Robert Lund

When the 1979 cars come out next fall, take a close look at the E body jobs from GM. The E cars are Buick Riviera, Cadillac Eldorado and Oldsmobile Toronado. Those are GM's most expensive wheels and the average guy backs off when he sees the price sticker. But don't pass up a close look at these cars—even if you don't intend to buy one, because the '79 E bodies will be milestone automobiles. They will mark the beginning of a new era in styling at GM.

You could put it even more strongly than that: the beginning of a new era in design of all U.S. automobiles. GM's influence and clout are so powerful, that very often as GM bends the metal, so does all of Detroit.

The E jobs will be the first cars out of GM to carry the stamp of the company's new vice president in charge of design, Irv W. Rybicki. He is only the third man in GM's history to hold the title of boss of all design bosses.

Rybicki, 56, comes from a different school than his predecessors—the up-from-the-ranks school. He did not attend college and the only formal training he had in art was in high school. He is a native of Detroit and his interest in vehicles stems in part from the fact that his father worked for the Detroit Street Railways, the public transportation system. (The middle initial in his name stands for Walter. "Walter was my father's first name and my son's middle name is Irv," Rybicki told an interviewer. "Using the father's first name for the son's middle name has been a tradition in our family for many generations.")

You may have heard or read that Rybicki started with the company at the GM Proving Ground in 1944. That's wrong. His first job after graduating from high school was in a tool and die shop of GM's Fisher Body Div. The job didn't last long because he went in the Army during World War II, returning to GM in February 1944.

If there appear to be gaps in Rybicki's formal credentials, he has more than made up for any academic deficiencies in practical experience. During his 34 years with GM, he has held the titles of project engineer, junior designer, designer, senior designer, assistant chief designer (Oldsmobile), chief designer (Oldsmobile and Chevrolet), group chief designer (Chevrolet cars and GMC trucks) and executive in charge of exterior design (all car lines, all trucks).

Rybicki's influence on the design of American automobiles will be felt for the next decade. He has nine years to go

before reaching GM's automatic retirement age, 65, and there will be at least a year of carryover for his ideas after he leaves the company.

PM recently talked with GM's new design chief about his job, how he got there, his thoughts on what's right and wrong in car design, European cars vs. American cars and what he sees for the future.

PM: The GM bio sheet says you began sketching and modeling cars "at an early age." How early?

Rybicki: The exact age is very difficult for me to pinpoint. I guess I was around eight or nine years old when I began sketching both automobiles and aircraft.

PM: Assuming you had the time to design other things—other than cars—what would they be?

Rybicki: The thought of designing anything other than automobiles has never seriously entered my mind.

PM: You have no interest other than cars?

Rybicki: No, I didn't say that. Away from General Motors I'm an avid reader and I enjoy gardening. Boats have always fascinated me and when the weather is right, I like to sail.

PM: How many cars do you own or drive? What makes and models?

Rybicki: For many years I've made it a practice to drive every car GM builds, also all models offered by our competition. I also like to drive as many foreign cars as possible. This is the only way to find out how our designs stack up against the competition. I don't have a single favorite I drive all the time.

PM: You've been in the business a long time, since the 1940s. Can you name some favorite cars produced during that time?

Rybicki: I'd prefer to list what I consider as outstanding cars without limiting them to a particular time frame.

PM: Okay, list them on that basis.

Rybicki: The early L-29 Cord introduced in 1929 still excites me every time I see one. In 1935, Cord brought out the 810. That really shocked the industry and has to go down as one of the great car designs of all time. The 1937 Lincoln Zephyr scooped the industry with headlights in the fenders

and has to be right up there with the best. The next year, 1938, Cadillac introduced a smaller personal luxury car called the 60 Special. That was the car that had the greatest influence in directing my career. It was fantastic, a real trend setter.

Today, I think the Jaguar four-door sedan is a beautiful design. The Chevrolet Corvette has always been and still is one of my favorites. The present Chevrolet Camaro and Pontiac Firebird are outstanding automobiles. They were first introduced in 1970 and for over eight years they have received only minor changes. But they still look great and sell well. They could easily become classic cars. Both the Olds Cutlass Supreme and Buick Regal, the '78s, are cars I love to drive. The current Cadillac Seville is another car that, in my book, has to rank as one of the all-time classic beauties.

PM: Let's exclude current cars. What do you regard as the outstanding GM car—in terms of design—produced during the 34 years you've been with the company? Your personal favorite?

Rybicki: I'd have to go back 40 years for my personal favorite. That would be the 1938 Cadillac 60 Special I mentioned a minute ago. It had a thin pillar and was the forerunner of the hardtop. It was the first production car without running boards and had a two-piece door that contributed to the convertible look. It also had a notch-back look that was a distinct departure from the traditional fastback of the day. As I said, a fantastic car.

PM: How long is the design cycle at GM now? That is, once you do a new car, how many years before you do it over?

Rybicki: The typical redesign cycle for an all-new car is currently six years.

PM: Do you look for the cycle to change—grow longer or shorter?

Rybicki: No, the six-year cycle will remain for the foreseeable future.

PM: A longer cycle would make your job easier, wouldn't it?

Rybicki: No, a longer cycle would make it more difficult. It would mean a model would have to be successful

(Please turn to page 202)

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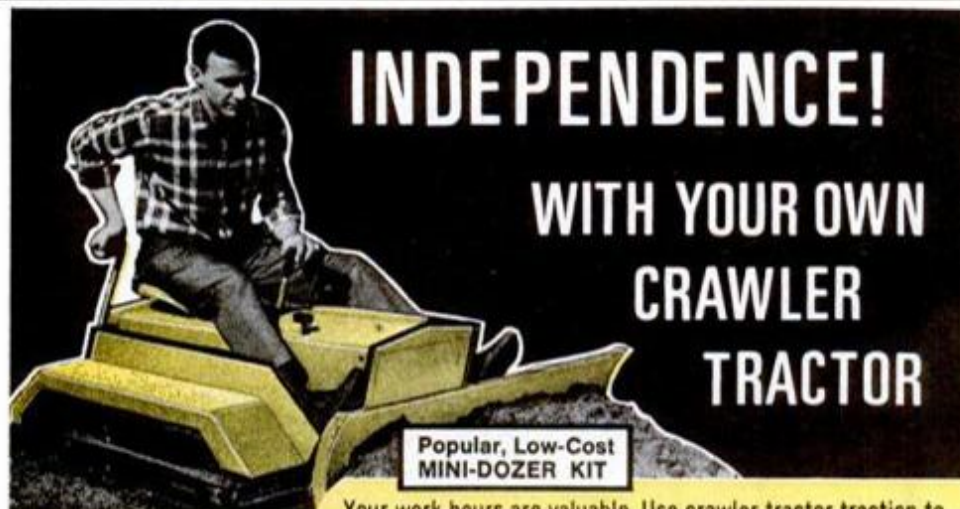
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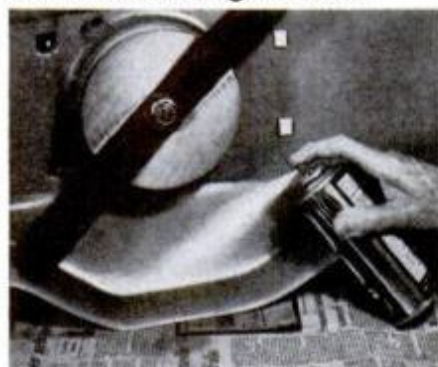
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Protective coating on mower



Coat or spray the underside of a new or cleaned rotary lawn mower with a thin film of lubricating oil. This will make it easier to remove grass accumulation and discourage corrosion. Soften dried grass with water for easier removal.

—Walter E. Burton

Popsicle-stick sander

Turn Popsicle sticks into sanding sticks by gluing a fine-grade garnet sandpaper cut to shape on both sides, so the sanding stick resembles an emery board. Use the stick to scrape rust or remove finish from small areas or from places that are difficult to reach.

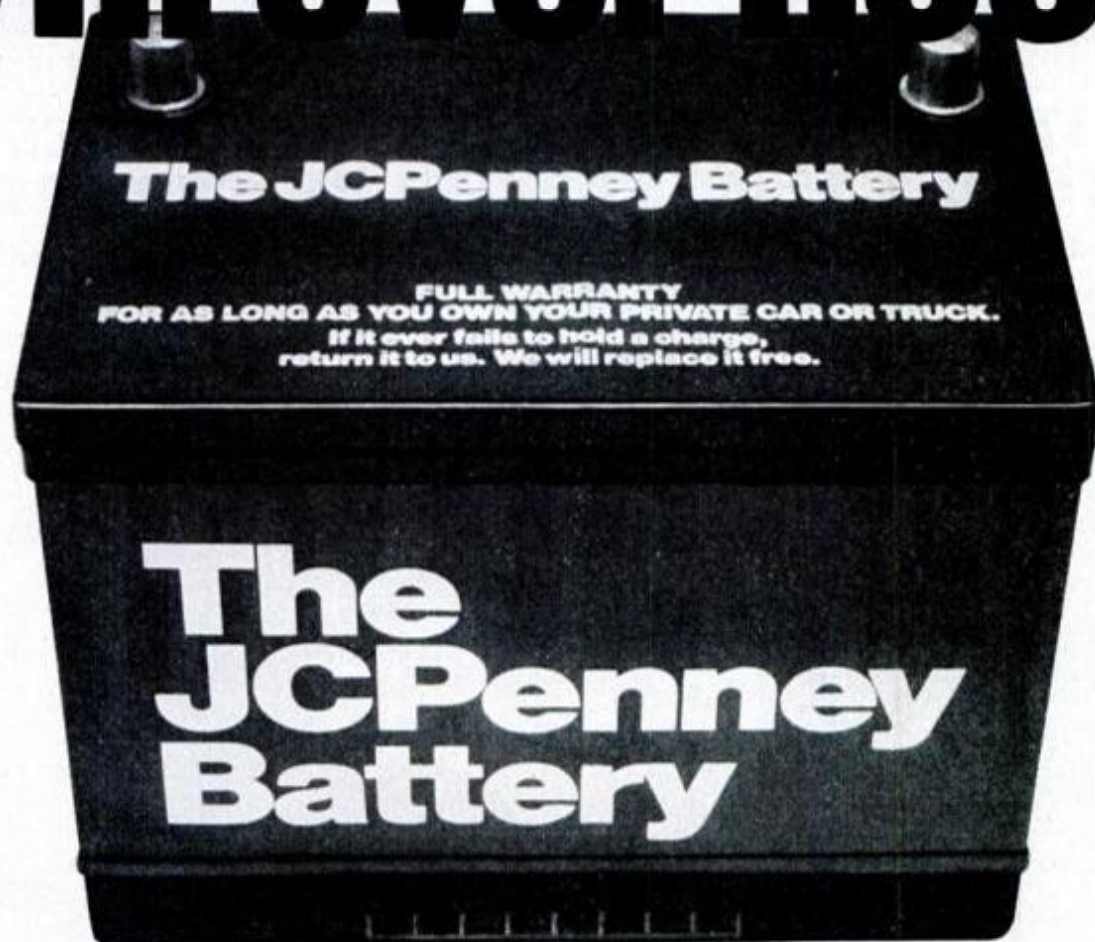
—Robert Frider

Funnel from an empty can



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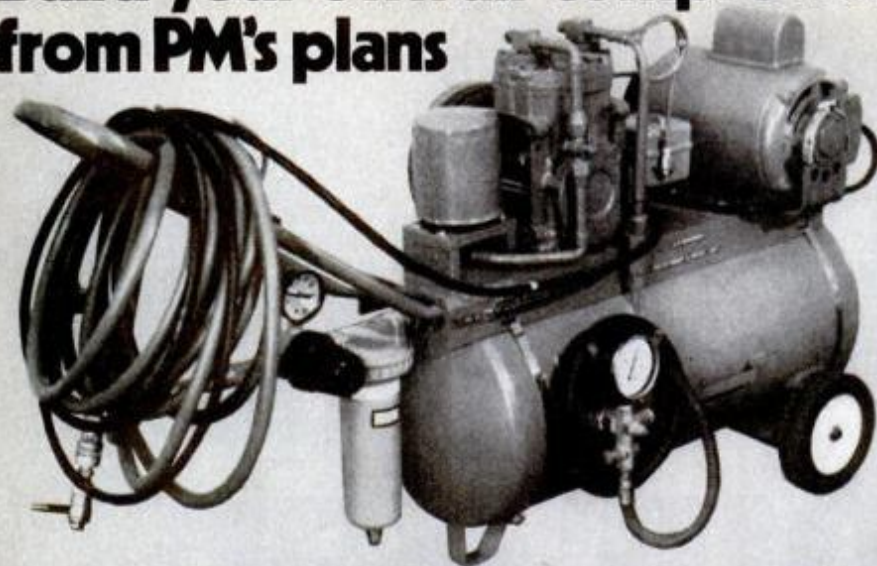
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Compressor evacuates car's airconditioning system prior to adding new refrigerant (far left). At left, routine inflation of tires saves trip to gas station.



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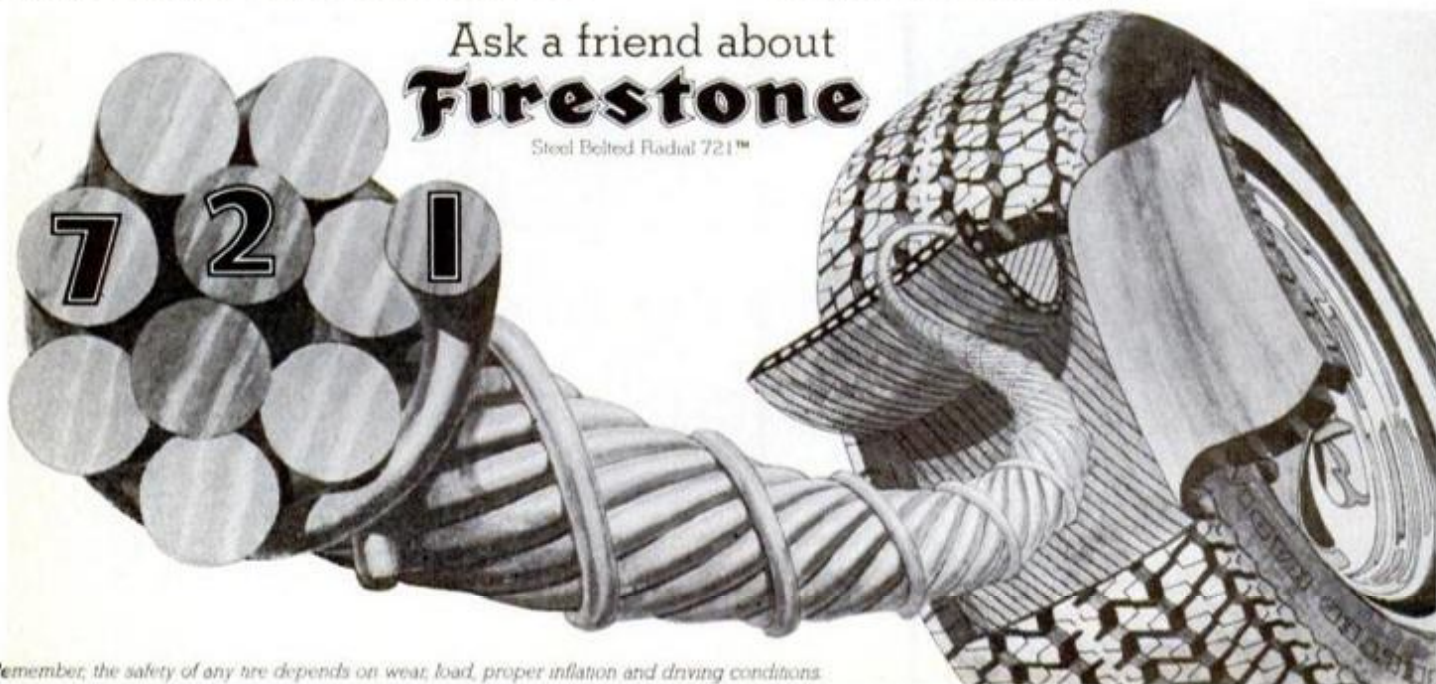
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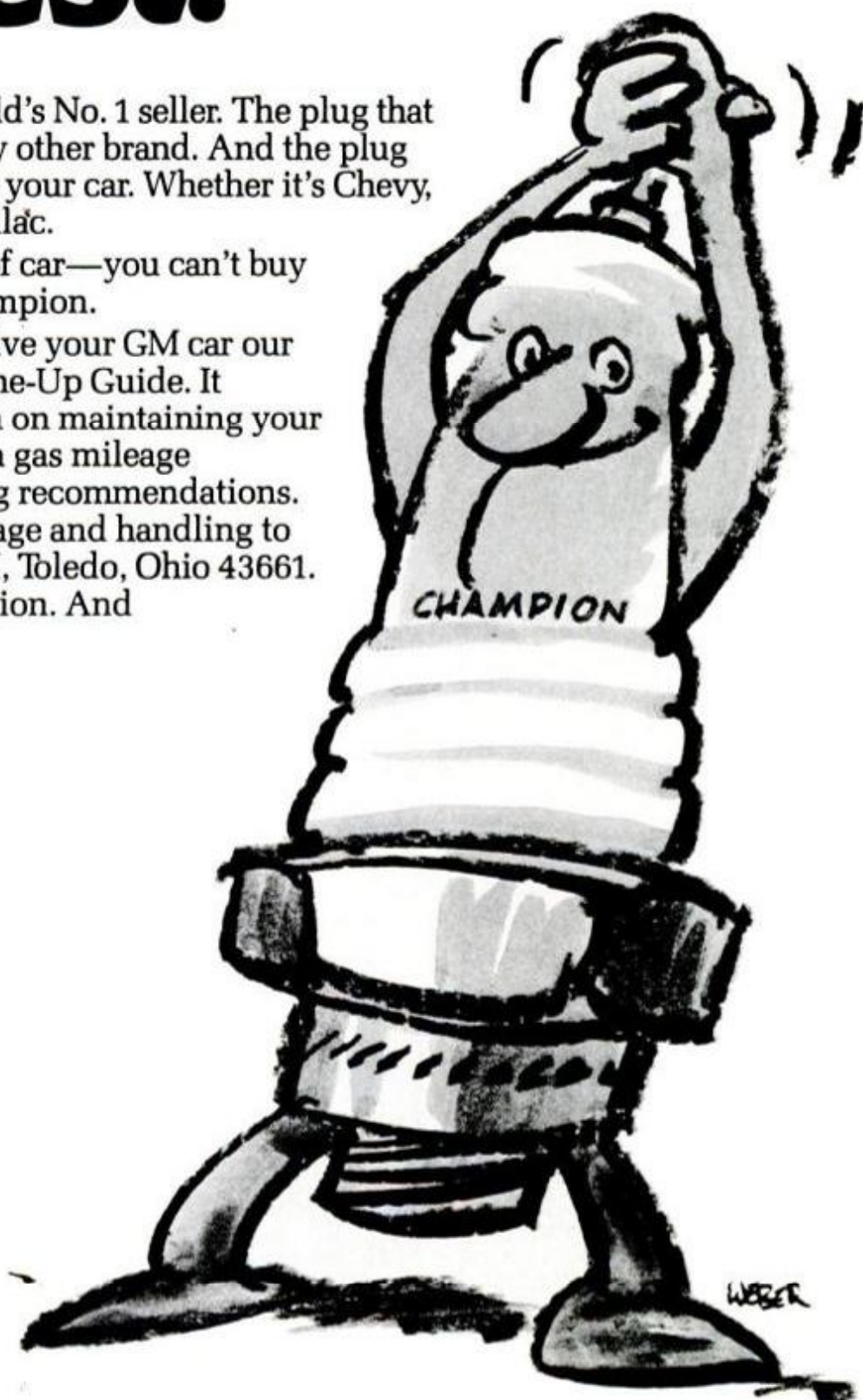
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This 5-gal. lawn and garden sprayer can be equipped with a handle for pushing or a tongue for towing. Four nozzles and two pumps driven by dual 10-in. wheels give a 3-ft. spray width. It's priced at \$120 by Broyhill, Dakota City, Neb. 68731.



New 11-hp garden tractor by Simplicity, Port Washington, Wis. 53074, tackles medium to large areas. Price: about \$1300.



The Craftsman Water Command Oscillating Sprinkler is designed to water an area up to 3100 sq. ft., and is especially useful for night watering. Just set the dial to the water amount needed—say, the equivalent of 1/4 in. of rain—and the sprinkler shuts itself off after spraying the correct amount. Under \$20 from Sears, Roebuck and Co.



As it wears down, line of this Model 8207 nylon grass trimmer is automatically replaced to proper cutting length. It's \$40 from Black & Decker, Towson, Md. 21204.



Disston's Yard Trimmer has a single line with cutting edges on opposite sides of a molded center hub. The balanced cutting action and 6-in. cutting radius boosts trimming efficiency, according to its manufacturer. The Trimmer and five extra cutters sell for about \$60. Disston, 601 Grant, Pittsburgh, Pa. 15219.

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There's a nifty little button under the dash that electrically unlatches the hatch. (You may open the hatch from the outside, too.)

It has three transmissions to choose from: 4-speed is standard, while easy automatic and frugal 5-speed are available.

There's simply much more than you'd ever expect in a car its size. But, for not much money. And that's the case with every GLC model: the GLC Standard 3-door Hatchback, GLC Deluxe 3-door Hatchback, and GLC Sport.

Mazda's Great Little Car is a great little car. You're gonna love it.



SPLIT REAR SEAT



CHOICE OF TRANSMISSIONS



REMOTE
HATCH RELEASE

*EPA estimates based on optional 5-speed transmission. Your mileage may vary depending on how and where you drive, your car's condition, and optional equipment. 42/33 mpg Calif.

**POE Los Angeles prices (slightly higher in California, and other areas). Taxes, license, freight, and optional equipment are extra. GLC prices for models not shown range from \$3245 to \$3920.

46
MPG H'WAY
35
MPG CITY*

mazda

GLC. Now, four great little cars in all, from \$3245**

ALL OUTDOORS

What's coming

The world's biggest indoor toy shop of outdoor gear and games is an annual spring event called the National Sporting Goods Assn. trade show. This year it recently overflowed Houston's AstroDome and Astrohall with a dealer preview of action equipment—everything from umbrella hats and stadium sleeping bags you can wear like a parka, to six-roller skateboards, for doing wheelies, and solar powered ice-chests. In between are a number of new and improved products that should make outdoor recreation more satisfying in '78.

■ **Shooting**—Winchester-Western will have a new line of XTR sporting arms, including bolt-action center-fire rifles in a variety of calibers, lever action .22s, slide and semi-auto shotguns with or without Winchoke tubes and ventilated ribs. Some may not be available at dealers until June. Xpediter Winchester-Western extra high velocity .22 long-rifle ammo will also be introduced. Commemoratives for '78 will include two 30/30 Model 94 carbines.

Remington is announcing 10 new ones, including a Model 700 bolt action center-fire Classic in six calibers; a Custom Deluxe 700 in 15 right-hand bolt actions, three for left handers, and six calibers of the heavy barrel Varmint Special. There will be a new lightweight Model 1100 LT-20 in six-barrel lengths and choke combinations of 20-gauge, and two 12-gauge pump action trap models. A Model 581 .22 clip repeater has a neat single-shot adapter for starting a youngster until he becomes experienced enough to use the 6-shot clip. Two autoloading Speedmasters and pump-action Fieldmasters come in rim fire.

High Olympic-style shotgun barrel ribs are available on Mossberg's new Model 500 Hi-Rib trap gun. It also has a RM-7 Sport Classic bolt action center-fire rifle with the handy rotary magazine for four extra shots. Marlin, H&R, Smith & Wesson and Ithaca are all announcing improvements and innovations. Colt will reintroduce a black powder 1860 Army .44 cap-and-ball revolver later this year.

BB guns are still popular, but larger air gun replicas of firearms are now offered with the balance and nearly the weight of gunpow-

der rifles and pistols. Crosman is introducing three additions to its extensive pump and CO₂ lines. Daisy models start with old favorites and progress through Power Line units with rifled barrels up to Feinwerkbau tournament pellet guns. Benjamin, Healthways, Ithaca, Marksman, Sheridan and S&W also announced improvements.

■ **Fishing**—Spinning reel anglers will be less likely to have lines slip and get tangled inside open-faced reels thanks to the present trend toward skirted spools. But St. Croix, maker of the new RF-70 closed-face Sport Reel, with its range finder/depth finder feature, claims that 74.7 percent of the 43 million fishermen in the United States now use closed-faced reels.

Daiwa and others will be selling a wider variety of miniature reels with graphite rods and lighter lines that offer more challenge. These, and the new telescopic rods, also break down into smaller pack-size units particularly convenient for the traveling fisherman.

■ **Knives**—The pleasures of owning a really fine pocket or sheath knife are becoming well known again, and a number of makers are now offering new designs and replica models. Kits for creating and customizing your own are also available. One good reference is the \$1 catalog from A.G. Russell Co., in Springdale, Ark. It lists knives, kits, books and sharpening equipment from a number of firms.

■ **Archery**—Robin Hood wouldn't recognize his sport this year. The compound Jennings bow we featured here as a novelty five years ago is now made by all big manufacturers. Designs for added mechanical advantage are revolutionizing this activity.

■ **Skin diving**—Refinements are the news for most scuba equipment and underwater photography items. The big improvement in gear is called B.C.—which stands for one thing with historians, another for flash cameramen, but means all-important buoyancy compensators to divers. A variety of types have become available in the last couple years, and there is now a Nautilus model from Dacor that is a rigid container rather than a Mae West-type plastic vest or collar and has automatic compensation capability.

■ **Boats**—The backwoodsman who wants to portage his little craft is

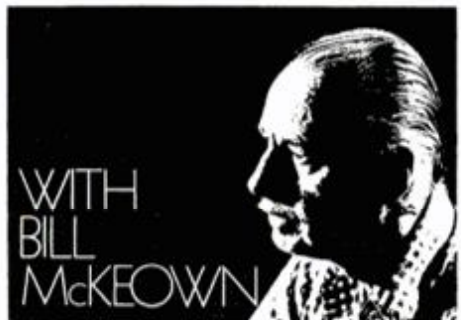
finding lighter and better hulls available. DuPont's Kevlar, a material used in place of fiberglass to lighten and strengthen some high-speed hulls, is now being tried in inflatables. Royalex, as a canoe material, is growing in popularity. And now Grumman, the name long synonymous with aluminum, is adding plastic to its line. The first prototype we have examined is rust-colored and appropriately called La Grande Orange. It is 18 feet long, weighs 90 pounds, has a fine entry and squared ends, and is rated for 790 pounds of passengers, gear and a 5-hp outboard. Bow and stern seats can be slid fore and aft.

■ **Camping**—The latest trend in tents seems to be the growing popularity of the hemisphere. Various makers will offer their versions of the dome-shaped Pop-Tent. All we've examined use flexible rods, usually inside, to provide framing without need for a center pole or exterior guy lines. But all, however, have provisions for tying and staking down with tent pegs if winds threaten.

Sleeping bags show the popularity of the new synthetic fillings (and the escalating cost of down). Materials such as Gore-Tex, that can let moist air out without letting raindrops in, are being used for parkas, tents, sleeping bag covers and bivouac bags. The refreshing idea seems to be catching on that flimsy, heavy and cheap materials and equipment can make camping uncomfortable, unsafe and, in the long run, unpopular.

■ **Clothing**—Outdoor wear that was once stiff, bulky and unattractive, is now getting the attention of good designers as it becomes popular for casual city as well as country use. Each cold- and warm-weather sport is developing its own special clothing, and ever since it has been found that women can challenge men in fishing, shooting, boating,

(Please turn to page 42)



THE DEPENDABLE MID-RANGE MERCURY OUTBOARDS FOR 1978.

OUTBOARD ENGINEERING TO RIVAL THE MOST DISTINCTIVE STANDARDS OF AUTOMOTIVE ENGINEERING.



One of these symbols is famous the world over for the ultimate in automotive engineering achievement.

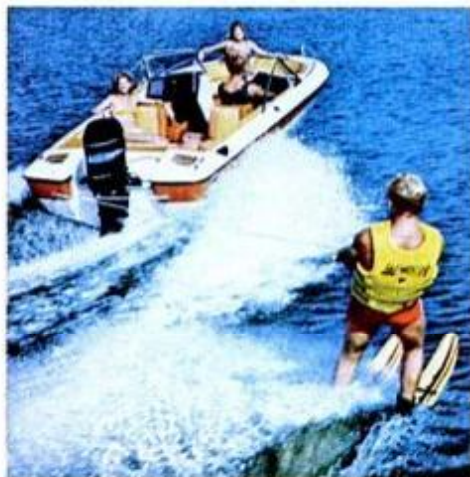
The other is carving out the same excellent reputation in outboard engines.

Black Max® Symbol of the new Mercury® Black Max Series. Three top-of-the-line outboards—150, 175 and 200 hp—with compact 60° V-6 engine design. The product of six years of uncompromising engineering, refining and testing.

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Now the same standards of engineering excellence achieved with Black Max have been applied to every Mercury outboard—from fast, dependable starts through remarkable fuel economy to ease of operation.

Mercury has gone all out to make the outboard of your choice—whether it's a small fishing Merc, a new 80-hp model, or a mighty Black Max—an extraordinarily dependable performer.

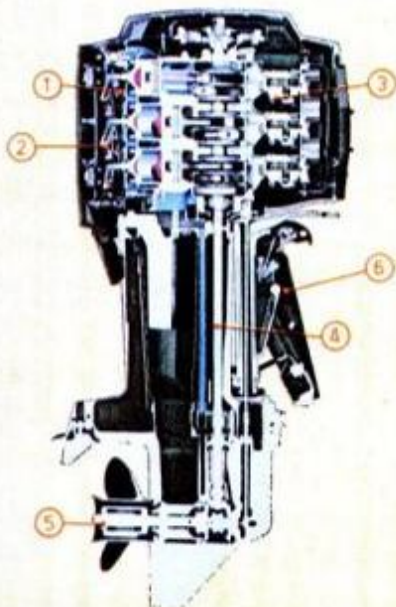


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EACH ONE ENGINEERED IN THE BLACK MAX TRADITION FOR YEARS OF DEPENDABLE POWER AND PERFORMANCE.

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In high-horsepower outboards, less horsepower per cylinder means less wear and longer engine life.

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THE SHALER CO.

Waupun, Wisconsin 53963

In Canada: Warren Packaging Co. Ltd.
Scarborough, Ontario

ALL OUTDOORS

(Continued from page 40)

golf, hiking and tennis, outdoor gear has shown up in women's sizes.

■ Accessories—Since so much outdoor action is around water, it's smart to provide for staying afloat and warm if you fall in. The Stearns AV-41 Inflatable Angler's



For stream anglers, Stearns vest inflates.

vest, \$59 at dealers, can be inflated by mouth or with a CO₂ cartridge. It isn't Coast Guard-approved because you must be conscious to activate it, but it could save your life.

The Harishok Shortie, from Ex-



Harishok Shortie PFD allows active sport.

tra Sport, Halesite, N.Y., about \$29, has CG approval and is light and flexible for paddlers and sailors.

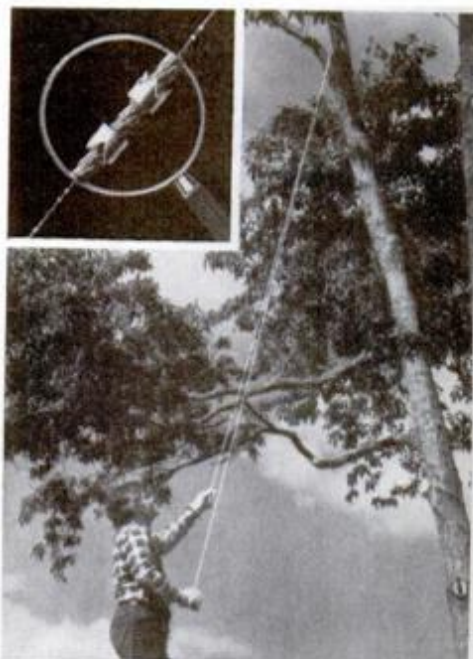
The Norwester jacket and pants, from Winel of America, Grafton, Ohio, provide both flotation and



Norwester suit also fights chill factor.

warmth for chill protection.

The High Branch Tree Saw made by Green Mountain Plant Products, Norwalk, Conn., combines two 25-foot cords, a flexible cutter and a weight pouch. One end of the cord is tossed over a limb, the saw cable



High Branch Tree Saw needs no ladder.

positioned, and the branch cut off by pulling the cords back and forth. Unlike a camper's wire saw, this \$20 unit can take a sharp bend.

Three-mile range and underwat-



Sylvania Distress Flash fires photo bulbs.

er operation without batteries are claims for GTE Sylvania's \$4.95 Distress Flash for outdoorsmen. Ten lamps can be fired, one at a time, using photoflash bulbs to signal for help.

Lur-Pal, a gadget that, at 3½ feet, will fit in a rod case, tele-

scopes to 10 feet to reach down and unhook a lure with its spiral snare. It's \$10.95 postpaid from Lur-Pal, Box 155, Elmhurst, Ill.

New shooting aids include a stainless steel .22 revolver from



Lur-Pal can rescue a lure 10 feet down.



New S&W .22 kit gun is stainless steel.



Even a Colt .45 can mount Leupold scope.



Winchester Model 1500, new XTR shotgun.

Smith & Wesson, a pistol scope from Leupold for even a .45 Colt Automatic, and new 12- and 20-gauge XTR autoloaders from Winchester-Western.

PM

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lasts longer than the leading car waxes.

Water beading proves it. Du Pont guarantees it.

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IMPORTS & MOTORSPORTS



Datsun B310 hatchback sports improvements like side-window demisters.

Son of B210

The successor to the B210 is already a familiar sight in Japan and it's sure to be well received here. The Datsun B310 shown above (and called the Sunny 1400 SGX in its home country) is the hatchback version in a series which includes sedan, coupe and four-door station wagon.

The B310 series was introduced in Japan late last year to replace the the 210, which is the most successful car in Datsun's history with over 5 million sold. The B310 is sharper looking still and promises the same extraordinary economy as the 210. Lower beltline and the increased glass area are obvious changes. Inside, a single stalk does almost everything but steer the car: It controls wipers, lights (high and low beam), windshield washer and directional signals. Under the skin, the 310 retains the strut front suspension, but will go to a four-link and coil-spring system in place of the leaf springs used on the 210. We'll have more on this oriental express when it gets here.

A hatch in every back

Someday a car with a trunk will be as unique as one with a rumble seat is now. A third (or fifth) door lets you utilize a sedan as if it were a station wagon. If you doubt that an extra door would make your motoring life easier, just ask a station-wagon owner if he could ever go back to a sedan. If you asked the question of me, I'd tell you that a

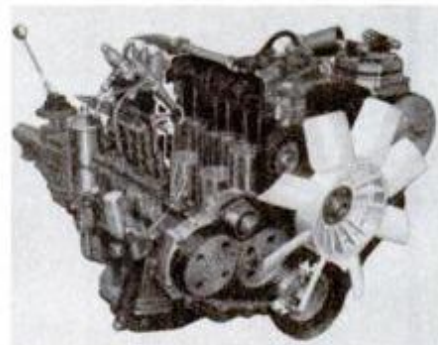


Saab 99 EMS goes hatchback for '78.

car without a tailgate is like a house without a back door! Saab introduced its first hatchback in 1974 and offered both three- and five-door models in 1977. For '78 the hatchback extends to the 99 EMS which is Saab's hot-dog sporty sedan.

Saab has a new sunroof for '78 that makes open-top motoring better than ever. An aerodynamic spoiler is formed in the roof panel when the stamping is made. This slight lip or hop-up eliminates the buffeting roar you get at speed with sunroofs that don't have spoilers of one type or another.

Gearing up for diesels



Isuzu 2-liter diesel: 62 hp at 4400 rpm.

There's not a single passenger-car manufacturer that is not researching the diesel engine as a near-future power plant. One, Mercedes-Benz, will even be depending on it for its survival in the U.S. market (selling more diesels is imperative to meet fleet average mpg figures).

The latest entry is Isuzu in Japan with the two-liter diesel shown above. The 62-hp Four is now available in the home-market Florian series, and could show up in the Isuzu-built LUV pickup, sold here. GM, remember, owns a third of Isuzu.

April is a classic month

As soon as a harsh winter is over and all car-killer salt has thoroughly washed off roadways (and into lakes and streams and around tree roots), immaculately kept, classic cars can roll on the roads again! This year the old-car season will climax on August 26 when the Monterey Historic Automobile Race is held at Laguna Seca, Calif.



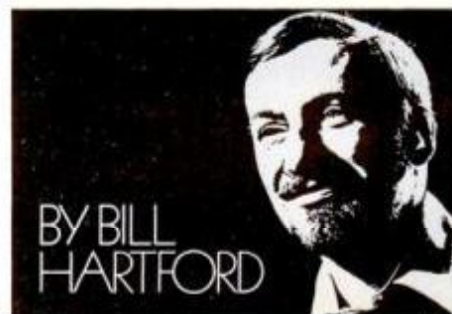
Honored marque: Mercedes-Benz 300SL.

The 28th Annual Pebble Beach Concours d'Elegance meets the same weekend on the Monterey Peninsula.

Each year organizers of the races honor a different marque. Last year it was the Bugatti; this year, Mercedes-Benz. M-B hasn't "gone racing" since 1955, but its successes are legendary (remember Barney Oldfield and his "Blitzen-Benz"?). For information write General Racing, Box 30628, Santa Barbara, Calif. 93105.

Comin' down the pike

A couple of nice, new machines are about to hit Main Street... Mazda has a two-seater sports car, the RX-7, ready for the U.S. Yes, it is rotary powered, and we'll have a report on what it's like to drive next month. The German-built Capri has always been one of our favorites, and for '79 it'll be built here and share its body with the Mustang. Both will offer red-hot, turbo-charged, 2.3-liter Fours. We'll have a sketch of the all-new body in Detroit Listening Post next month and the full story in August. **PM**

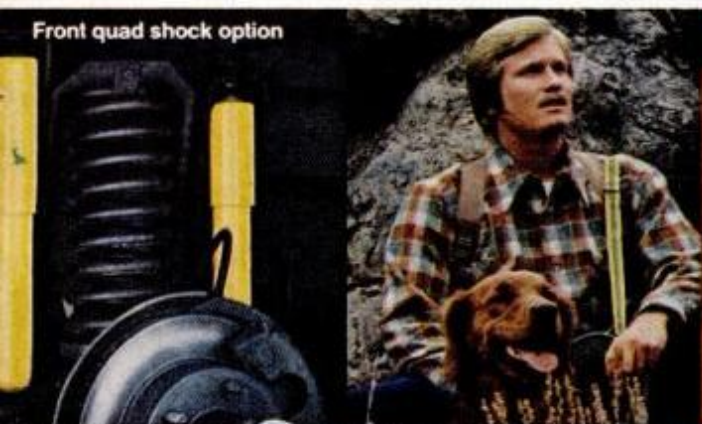


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Front quad shock option



Choice of part-time 4WD



Rear flip-fold seat option



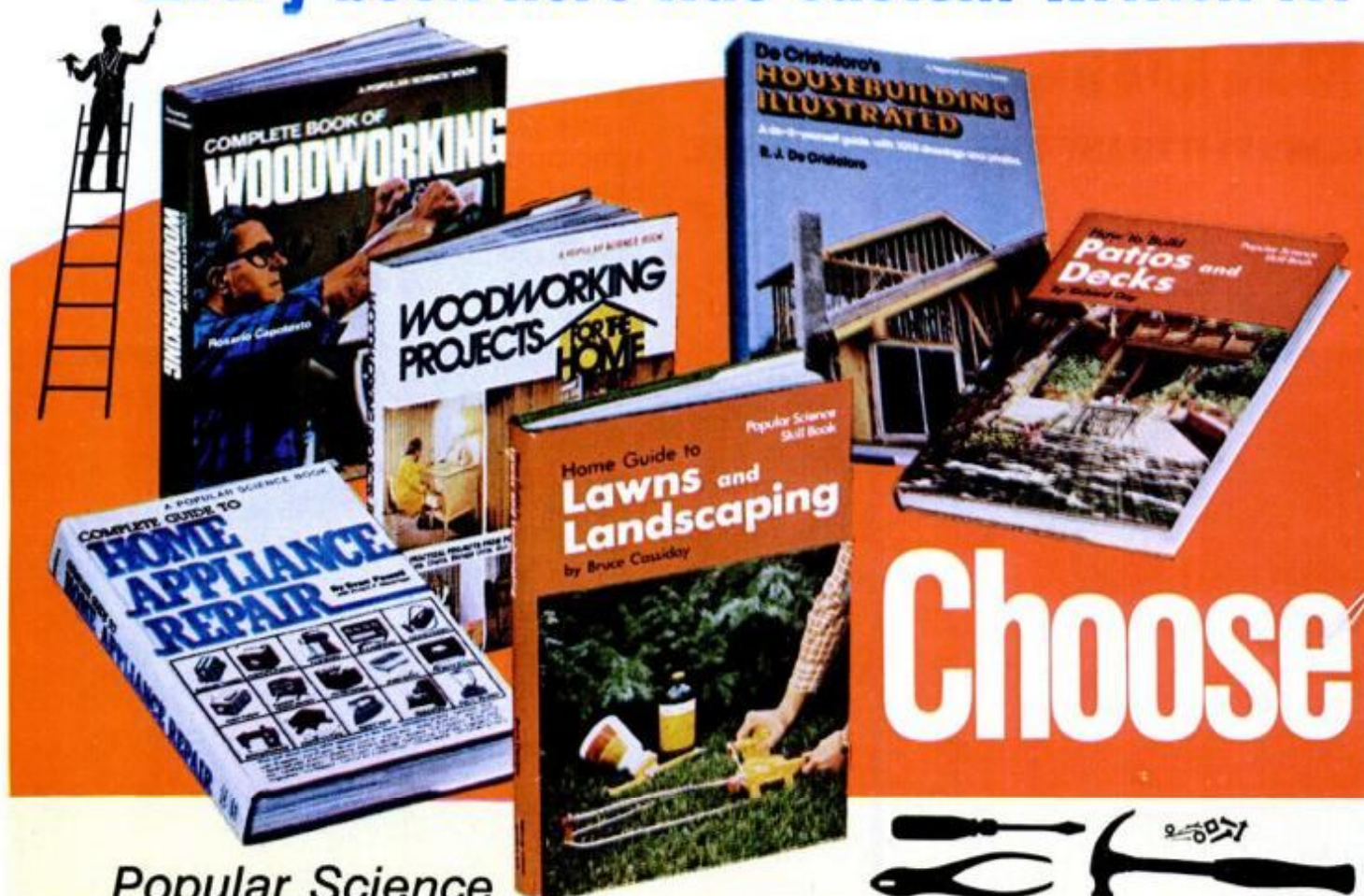
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PM LOOKS AT A WALL PATCHING KIT

A new method for the repair of holes in plasterboard—Wonder-Patch has been introduced by William Zinsser & Co., Inc., Somerset, N.J. While the product looked gimmicky at first, I found out that it isn't (as can be seen in the photos). The kit provides an effective way to fix holes fast.—H.W.



Patch kit sells for about \$3 at most hardware stores, or write manufacturer.



Cut through wall shows how the patch holds. See below for how to use it.



1. Hole in wall is enlarged just enough so corrugated patch can slip through.



2. Patch is sized to hole. You leave enough all around to bear against wall.



3. Once inside, flap is flattened, then pulled flush against wall being repaired.



4. String is held taut while bolt is turned through Tinnerman nut in the flap.



5. Bolt is fully tightened to reach opposite wall, holds patch firmly in place.



6. Patching compound, included in kit, is applied, allowed to dry, then sanded.

With Elmer's Carpenter's Wood Glue you don't need a pro's hands to give it the pro's touch.



Elmer's® Carpenter's Wood Glue is a special wood glue for all your woodworking projects. It penetrates well in hard and soft woods and forms a heat and water resistant bond that's stronger than the wood itself.



It's also better because it "grabs" immediately and dries fast. Yet it allows realignment before it sets. So you can join surfaces as soon as it's applied.



Elmer's Carpenter's Wood Glue is also sandable, paintable and gumming resistant. Its non-toxic*, solvent-free formula also washes off your hands and project with water. So you won't get light spots when you stain near glue joints.

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We've been developing and perfecting this new oil for more than three years. And testing it for 2 million miles. In autos, vans and pickup trucks, old and new

cars. In cities, on the highway, in all kinds of weather.

We found New Generation All Season protected the engines up to *twice* the time span and *double* the mileage. However, in cars under warranty, change according to manufacturers' requirements.

Today's engines are complex machines. And, many things, such as dirty spark plugs, faulty carburetor, dirty air filter can affect their over-all perform-

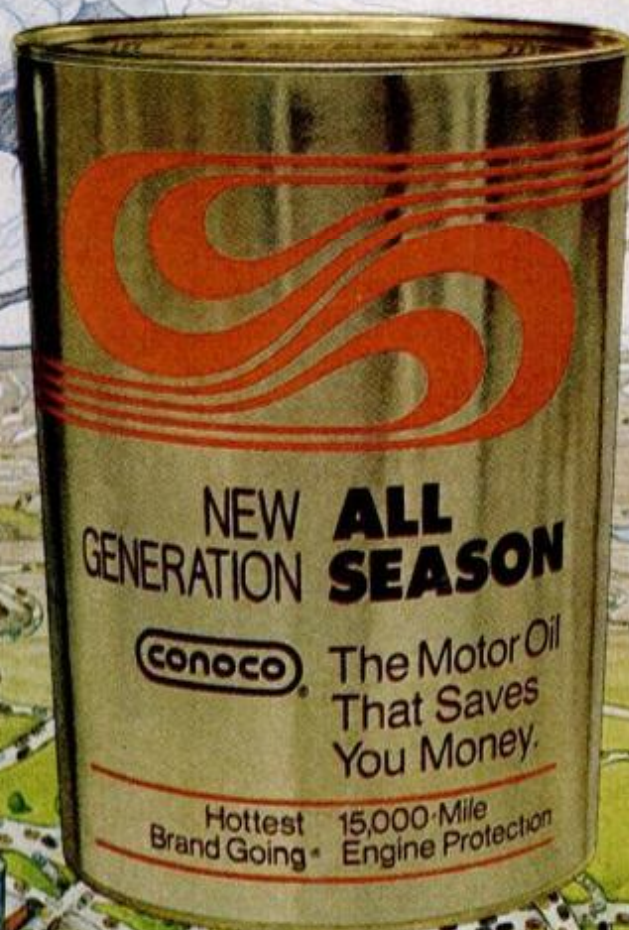
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Daring young bikers

by Richard F. Dempewolf

Exuberant kids in London's borough of Hackney can let off excess steam by signing up with the Imps—a motorbike display team invented by community dads to keep their youngsters off the streets.

The program, known as the Hackney Adventure Project, involves boys of 6 to 15 in age. All are being trained as precision riders, capable of performing most tricks of the stunt riders, including ramp jumps over obstacles and flying jumps through fire. High-risk events are limited to older riders. One spectacular precision stunt is the "pyramid," involving almost the entire team. One by one, the kids climb aboard a moving, full-size motorcycle piloted by trainer Roy Pratt (a London police officer) and assume carefully worked out positions for a balanced arrangement. Top man, on the driver's shoulders, gets on last as the vehicle accelerates.

Each member now has his own bike. Those from 6 to 11 ride mini Italjets; others, 12 to 15, use Honda trail bikes. Each has a blue uniform and crash helmet.

Maintenance is handled by pit crews who join the team because of

(Please turn to page 54)



Imps build pyramid, with coach driving.



Scott Martin, 9, shoots off low ramp.



Fire jump is specialty of Matt May, 10.

GM

Chevrolet

New Chevy Nova.

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available equipment. The Nova is equipped with GM-built engines produced by various divisions. See your dealer for details.

Chevy Nova. A wanted car.

*Manufacturer's suggested retail price for Nova Coupe, including dealer preparation. Available full wheel covers (\$37) and white stripe tires (\$36) shown. Tax, license, destination charges and available equipment are additional. Priced higher in California.

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PHOTO HINTS

Save reject slides



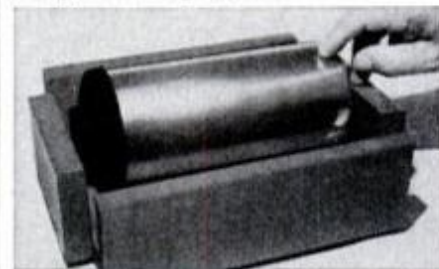
Need some opaque slides to fill the open slots in the projector tray while editing your pictures? You can use rejected slides covered with black tape—they'll eliminate those blinding flashes of white light that occur between slides.—*Robert Hertzberg*

Date'em

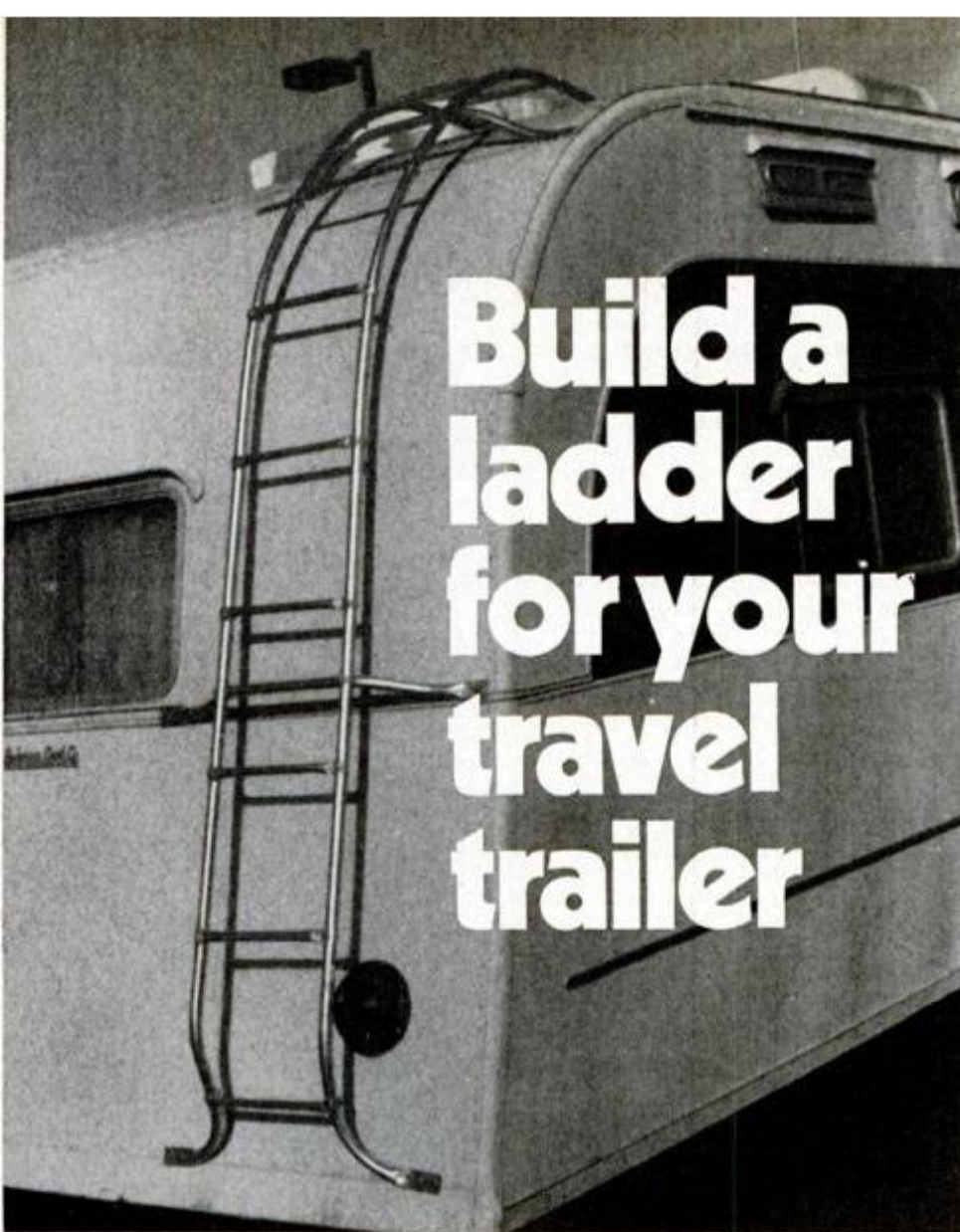


Stamping or writing the shooting date on each of your pictures should be a rule. A few weeks or many years later, the date can be invaluable. Date stamps with small numbers—ideal for slide-mount edges—can be found in some office-supply shops. India ink works on negative edges and movie leader.—*Walter E. Burton*

Easy, sure agitation

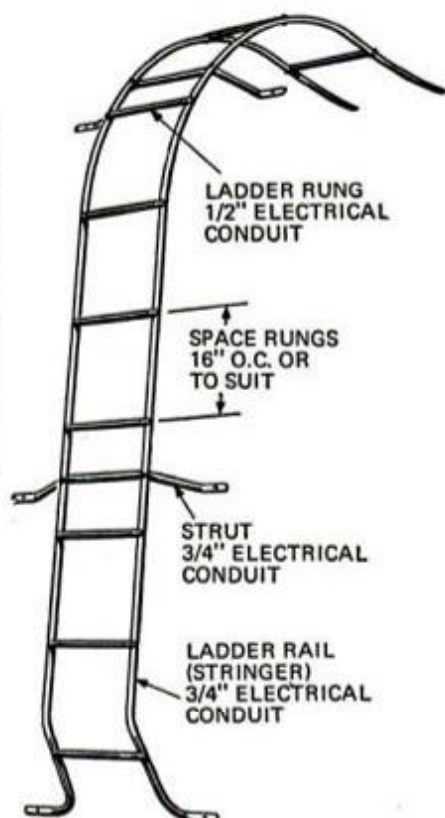
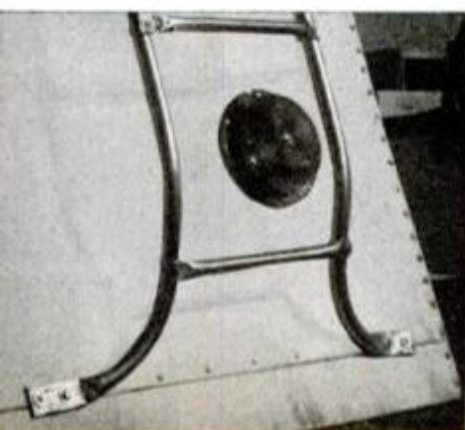


Instead of agitating a developing tank like a cocktail shaker, put it in a shallow box made of wood scraps and roll it gently from side to side every minute or so. The film will come out without streaks or spots.—*Robert Hertzberg*



Build a ladder for your travel trailer

Rails are secured to the "ribs" or structural framework at the roof and lower rear panel of the vehicle. Struts steady ladder and hold it away from the body wall.



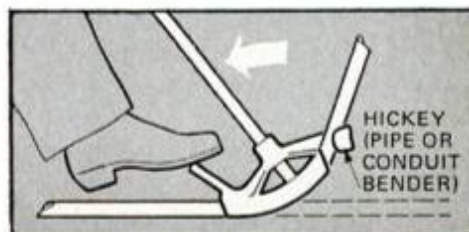
The roof space atop many vans, trailers and pickup campers isn't of much use for stowing gear unless you can get up to it easily. This sturdy access ladder can be constructed to most formats for less than \$20.

Materials for the ladder shown include two 10-ft. lengths of $\frac{3}{4}$ -in. dia. electrical steel conduit for the rails, one 6-ft. length for the two struts and a 12-ft. length of $\frac{1}{2}$ -in. conduit for the nine rungs. Use $\frac{1}{4}$ -20 x $1\frac{1}{2}$ -in.-long machine bolts, washers and nuts to secure rungs to the rails and $\frac{1}{4}$ -20 x 2 in.-long bolts to hold rails to the struts. Use $\frac{1}{4}$ x 2-in. lagscrews to fasten the rails and struts to the trailer—and a liberal dose of silicone caulking around each lagscrew penetration.

For a start, shape the first uncut rail length to suit the wall contour. Use the wall surface itself as a form for bending the tubing. While calculating the finished rail length, don't forget to include enough tubing for forming the 6-in.-deep (inside to inside) offsetting configurations at the top and bottom of the rails. You can rent a tube-bending device (hickey) to form the offsets. When the fit is satisfactory, cut off excess tubing with a hacksaw and form the second length to match. Use a hammer or vise to flatten the tubing ends and file or grind all sharp corners round.

Struts are bent with the hickey to form a shallow basin shape with a 15-in. base 6-in. deep and 30-in. long overall. Treat cut ends as described above. Use a center punch to mark ends and put tubing in a vise for easy drilling. Struts may now be attached to the wall with lagscrews. Next, clamp rails to the struts 14-in. apart. Lagscrew the rails to the roof and wall and then join the struts and rails with machine bolts. Washers behind boltheads and nuts help keep tubing from crushing. Cut as many 15-in.-long rungs as required. Flatten, punch and round off each end. Clamp the bottom rung as low as possible on the rails and drill and fasten. Continue by adding the remaining rungs as you ascend.—

Christopher Clark



A hickey helps form bends up to 90° in steel tubing. Accurate duplication of bends to form symmetrical struts and rails assures equal stress points on ladder.



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PM



Smith practices using electric hand by lifting and replacing dowels in holes.



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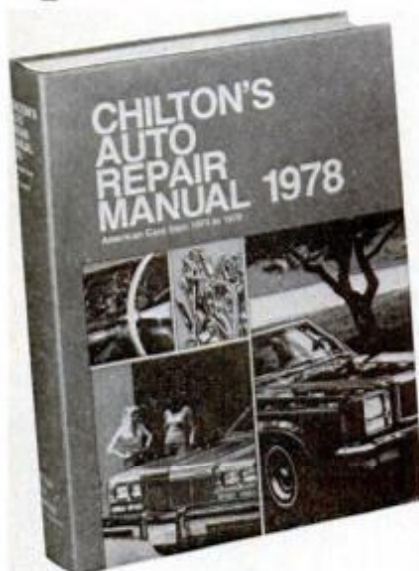
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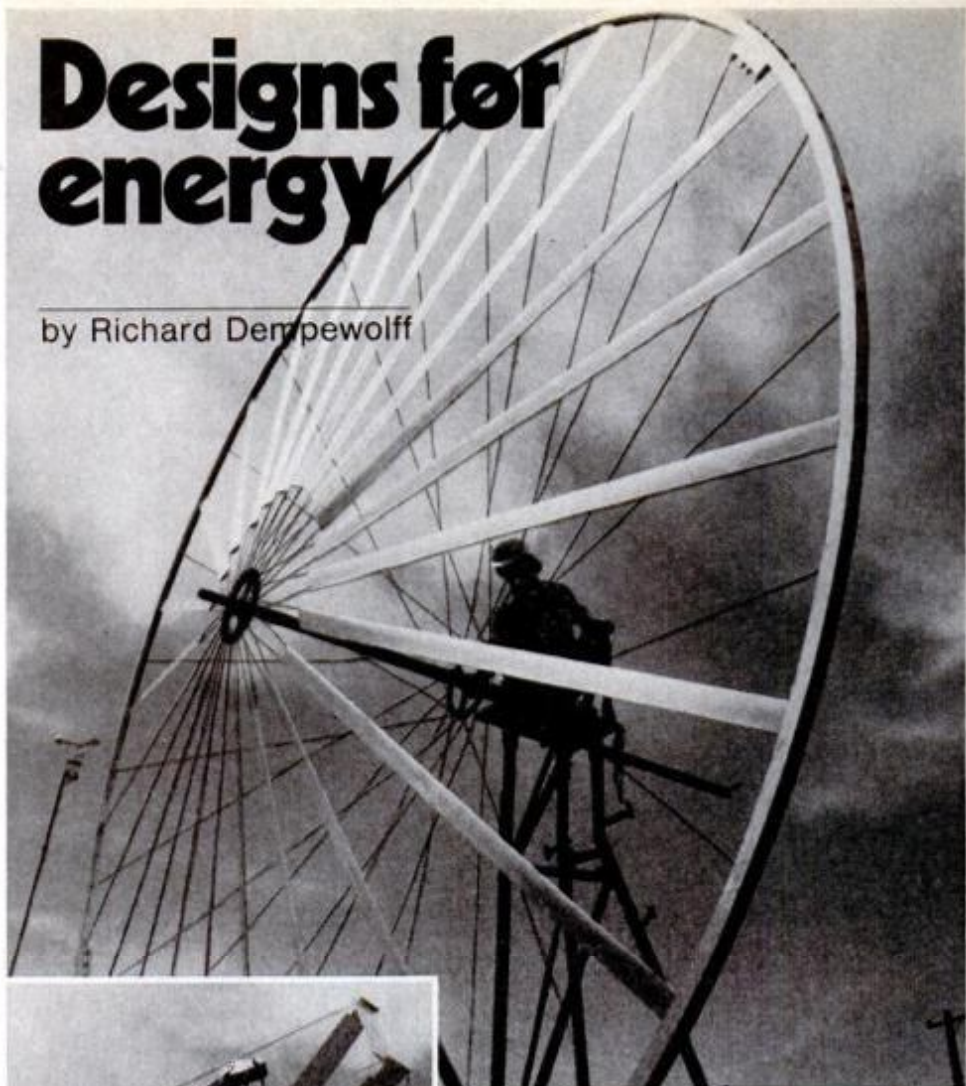
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Designs for energy

by Richard Dempewolf



"Bicycle wheel" windmill, 20 feet high, generates power and attention for Univ. of Cal.



Oklahoma's vertical-axis wind turbine on top of a tall tower took first place in the contest's wind innovation category.



Challenged by the problem of producing electricity with "any energy source other than oil or gas," engineering students across the nation came up with a unique assortment of contraptions and systems. They ranged from Kansas State's grand award-winning system for burning sorghum juice to produce ethanol, which burns in an engine that drives a generator, to powerful solar reflectors that sizzle water into high-pressure steam,

spinning a generator to turn out high-voltage electricity.

The contest was sponsored by SCORE (Student Competitions on Relevant Engineering) and funded by grants from the Department of Energy (formerly ERDA), plus private corporations and foundations. The significant part of Kansas' sorghum project is that the key product is the state's abundant crop. Other winners were just as ingenious. Oklahoma students came up with a tur-



Self-starting vertical windmill won a third for Washington State University.



Concentrating solar collector generated steam and a first place for Georgia Tech.

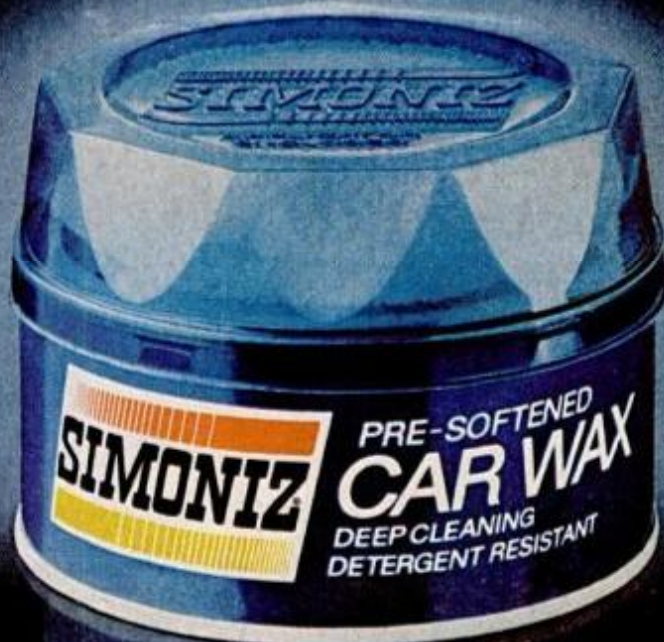
bine powered by a vertical-axis windmill in which the angle of the blades can be controlled to produce optimum performance. West Virginia University contestants invented a system that produces methane from biological waste. The methane gas operates a motor that spins a generator.

A solar collector involving an array of eight parabolic trough reflectors focuses the sun's rays on water-filled tubes to produce steam for a turbine-driven generator. This design was a University of Texas winner. But first place in solar energy concepts went to Georgia Tech for a solar collector controlled by micro-computer. Steam from a boiler located at the focal point of a curved system of mirrors powers an old-time single-piston, double-acting steam engine that is coupled to a generator.

SCORE's "Energy Resource Alternatives" competition was the second round on energy in an overall program aimed at dealing with "real-world engineering problems." **PM**



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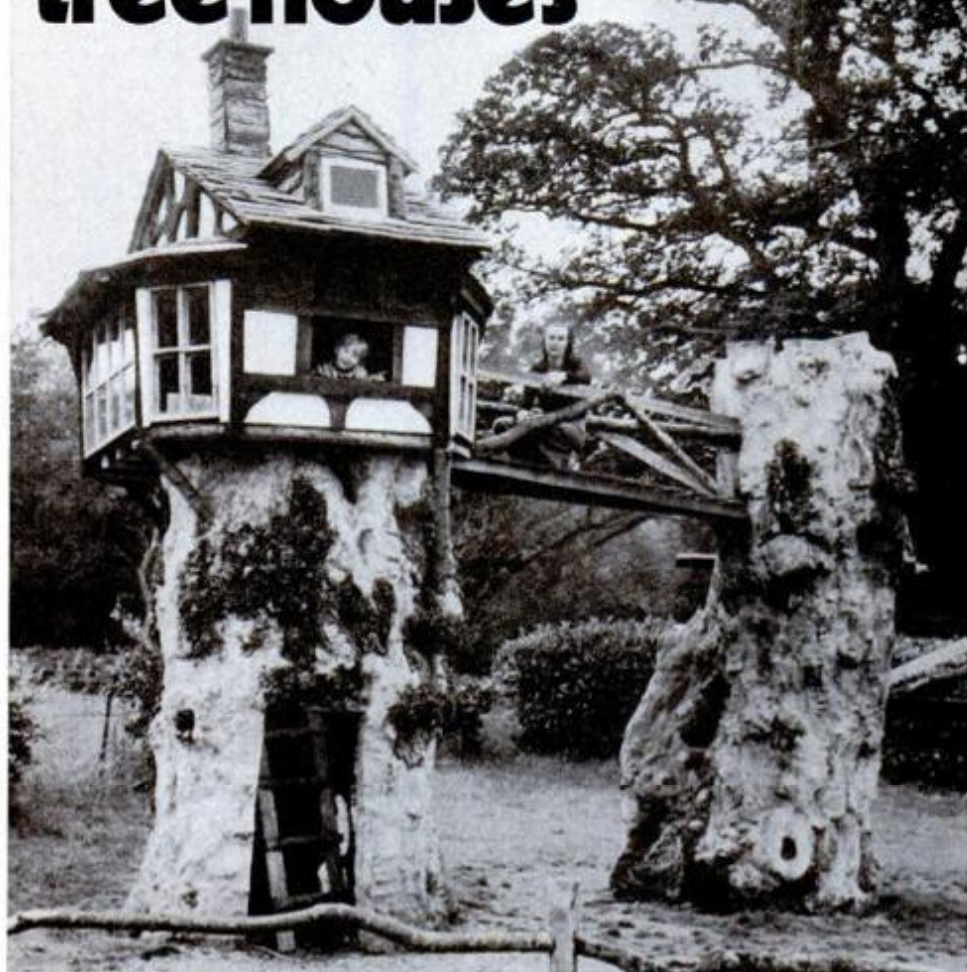
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Forest of tree houses



Samples of Wendy Houses and other types of elaborate tree houses are always on display outside the Bayliss shops. One of the fanciest (above) involves a chalet atop a hollowed-out tree trunk, plus a bridge across to another hollow trunk. The houses displayed at right are in work. Note hollow elm sections in the background. Below, Bayliss consults with a customer.



by Richard F. Dempewolff



What's a "Wendy House?" Probably the most house for the least money you're apt to find these days. You can get one for as little as about \$200—or up to about \$3000 if you must have elaborate variations. The hitch: You'd better not be more than four feet tall on your tiptoes if you plan to enter the doorway standing up.

The first Wendy House was built to order for Leslie Bayliss, a young three-foot-tall English lady, by her daddy, some 17 years ago. Bayliss,



Chairs and tables are designed to conform to gnomish architecture of houses.

member of a timber and building firm in Surrey, had been prevailed upon by his wife, Wendy, to do something about a playhouse for their daughter. Instead of just whacking together a few plywood panels, Bayliss had a better idea. He knew that Britain's huge old elms were succumbing by the thousands to the Dutch bark beetles. Some trees, from 200 to 400 years old, had trunks up to six or more feet in diameter. Those that had not been salvaged promptly were rotten in the center, but had a shell of sound wood under the bark. By hollowing out the center of such a trunk section, cutting in some odd-shaped windows and a door, and topping it with a roof of hand-split shakes, he wound up with a gnomish "gingerbread" house which he named for its promoter—his wife, Wendy.

Once he'd set it up in the garden, Bayliss found himself bombarded with requests for duplicates—so relentlessly, in fact, that he was forced into the Wendy House business.

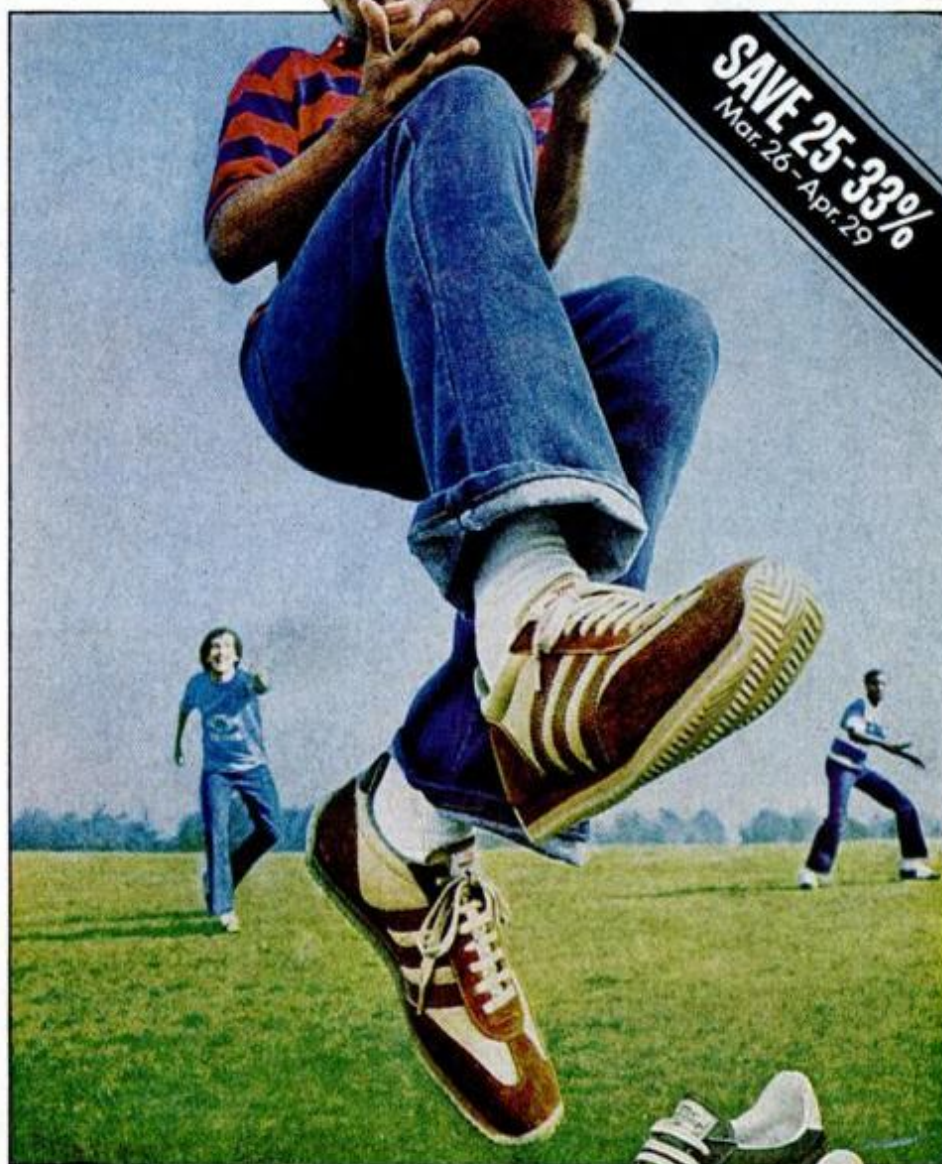
Today, Bayliss contracts to cut and remove dead elms. Big ones are hollowed into Wendy Houses as is. Smaller ones provide pedestals, with a door cut in the side and a stair going up the middle to a Hansel-and-Gretel-type tree house perched on the top.

Houses are made to order for the small folk who will be using them. Conferences are held with four-to-eight-year-old prospective residents, who designate requirements in windows, furnishings and such.

Currently, Bayliss and his staff of about a dozen craftsmen are operating at capacity production of more than 50 Wendy and other tree houses a year.

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HINTS FROM READERS

A lift for your mower



An extra handle mounted on the top, front part of a rotary mower is invaluable when you're lifting the machine. The handle shown is $\frac{1}{8}$ - x 1-in. aluminum bar bent to suit. Use lock washers to help secure the $\frac{1}{4}$ -in. nuts.—*W.B. Eaton*

Shade is portable drop cloth

A roll-up window shade carried in the car comes in handy if you have to change a tire or work under the car while on the road. Just unroll the shade and kneel or lie on it. The shade also shields car interior when transporting dirty or sharp objects.—*Howard E. Moody*

Aquarium pump cleaner

Clean water filtration pumps for aquariums by pumping pure chlorine bleach into a bowl for 10 minutes. Tap the pump firmly to dislodge algae. Pump fresh water to rinse thoroughly, then rinse with a chlorine-removing chemical sold at aquarium suppliers.—*W.J. Whitley*

Extenders keep towels rolling



No matter how expensive a plastic paper-towel holder I've bought, the arms eventually spread apart and the rolled towels drop off. I fastened a 1-in.-thick slice of 1-in.-dia. dowel to each arm hub with a stovebolt. Span is reduced by 2 in., and though the roll of towels still goes on easily, it never drops off.—*E.V. Reyner*



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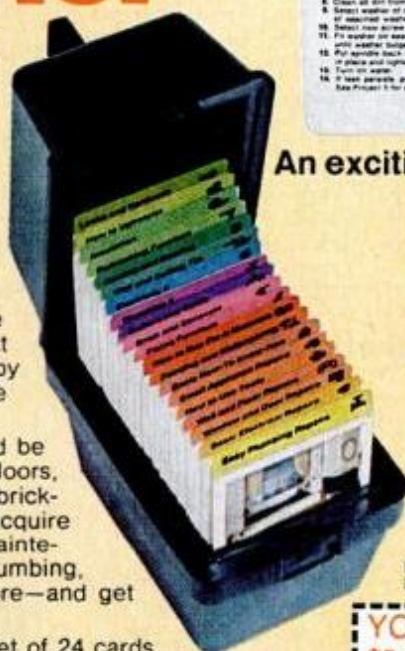
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CAR CLINIC

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BY MORT SCHULTZ



Fountain of Yecch

Transmission fluid splashes the undercarriage of my 1976 Chevrolet Suburban, and a sizable puddle is left when I park. This has continued for 1½ years despite the dealer's efforts. He has installed new bushings, yoke, input and output shafts, front and rear seals. What's the answer?—Ron Nahas, Floral Park, N.Y.

Is your vehicle equipped with the Turbo Hydra-Matic model 400 transmission or another?

If it is one of the 400s, the answer is to install a one-inch deeper oil pan and modify the dipstick, but fill the unit with the same amount of fluid as you've been doing. THM 400s have been blowing fluid out their filler pipes because pans have been undersized. If your dealer wonders where you got this information, refer him to newly issued service bulletin 78-1-8.

If your transmission is not a 400, examine the case and pump body for hairline cracks. With all the work which has gone into this unit, an external defect, such as a cracked housing, is more likely than an internal problem.

Manual-to-power steering

I want to convert my 1971 AMC Hornet from manual to power steering. I'd like to know if it's possible, what the job entails moneywise and what the job entails workwise.—Sergio Petulla, Ozone Park, N.Y.

It's possible. Moneywise it will cost about \$255 for three parts kits if you buy manufacturer's equipment (AMC Nos. 8122600-M, 3191002, 3190981). Workwise it isn't too tough. Follow detailed instructions that come with the kits.

Changing allegiance

I'm about to give up on my 1976 Chrysler's electronic lean burn 400-cu.-in. engine. It has logged more hours at the Chrysler shop than on the road because of ping-ing, stalling and crazy idling (either too slow or too fast). A new

computer has been installed, but the problems continue. GM, here I come.—Frank V. Cordo, Utica, N.Y.

Don't do it, yet, Frank. Give an ear to what I've got to say (no offense, GM).

Like many things that are new, lean burn has had its share of bugs, but Chrysler has been busy stamping them out. In your case, the following "pests" may have been overlooked:

□ Use of the wrong spark control computer. Computers are not interchangeable from year to year. If a 1977 computer was installed on your 1976 engine, the engine won't perform properly. A new spark control computer for your engine carries part No. 3874875; a remanufactured computer, No. 4026090.

□ Excessive spark advance. The pinging (spark knock) problem can be controlled by installing a vacuum reduced (part No. 4091910) in the line to the vacuum transducer, thereby reducing the amount of spark advance.

□ Defective pickup coil assembly. Your problems may be caused by a weak pickup coil assembly in the

distributor—not by the computer. You can find out by warming up the engine, disconnecting and plugging the vacuum hose on the vacuum transducer, and placing a clean piece of paper between the carburetor switch and curb-idle adjustment screw. Let the engine run for at least six minutes. Then, reconnect the vacuum hose to the vacuum transducer. If the engine misses, backfires and dies out, replace the pickup coil (part No. 3874672). See that the air gap is to specification.

□ An electrical interference. This can be verified by hooking up a timing light, starting the engine, turning on the headlights, placing the blower motor on high and switching on the heated rear window. If the timing mark becomes very erratic, reroute the black alternator ground wire so it lies over the right valve cover. It will be necessary to undo the ground wire bolt at the alternator and rotate the wire about 120°.

Desert rattler

My new 1977 Mercury Monarch with in-line six-cylinder engine has a vibrating rattle associated with the air conditioner. The rattle occurs at idle and on acceleration when the air conditioner is engaged. It is not present when the air conditioner is off. The service manager told me that if I had wanted an airconditioned Mercury Monarch, I should have bought an eight-cylinder—that I'll have to learn to live with this rattling Six. Do you agree?—Lt. Col. (Ret.) Clyde E. Arnett, Tucson, Ariz.

The service manager has been in
(Please turn to page 70)

Illustrated tips by the bookful



To do routine maintenance and service, all you need is the owner's manual that comes with your car. It's got the basics and gives specs like plug gap and other settings. But when you're really serious about car care and, specifically, repair, it is essential that you have the complete story in a volume devoted to your car. The factory shop manual can't be beat for every last tolerance, dimension and part number, but it's written for pros; unless you know the language, you'll have trouble. You should use the *Motor Maintenance & Repair Guide* for your car. It has a fine trouble-diagnosis section. You can get a volume for any popular make and model for \$7. Motor, 1790 Broadway, New York, N.Y. 10019.



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TV REPAIR GUIDE

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Lights, 14 mg. "tar", 1.0 mg. nicotine; Filter Kings, 16 mg. "tar", 1.1 mg. nicotine; Longs, 17 mg. "tar", 1.2 mg. nicotine av. per cigarette, FTC Report Aug. '77

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CAR CLINIC

(Continued from page 68)

the sun too long. This airconditioner blower motor noise can be stopped by installing a new assembly (part No. D7DZ-19805-A), which has the blower motor encased in a rubber insulator and secured in a tight-hold mounting plate. The same "fix" applies to 1975 and 1976 Monarchs—Ford Granadas of the same vintage, too.

Confession

I'm taking some credit for helping to solve a problem that's been around a long time—milky fade-out of simulated (vinyl) wood grain siding on station wagons. I plead guilty to being a bit surreptitious about the way I did it. But my method worked. Here's how!

In the November 1977 column, I printed a letter by J. Macher of Cranford, N.J., who had the problem. My answer reflected "official" carmaker advice: "Wash and wax." Deep down I knew *Car Clinic* readers were going to scream "balderdash," and give me their solutions. Well, I've been flooded with mail and what follows are various solutions, each of which works, or so

the one who submitted it claims: □ P. L. Higgs, Piqua, Ohio—"First remove all road dirt and wax. Then apply clear lacquer from an aerosol can. This brings the color back to the finish and seals it."

□ Gene Hill, district manager, AAA, Wenatchee, Wash.—"Armor All, manufactured by Very Important Products, Inc., Newport Beach, Calif. 92660, works miracles. I didn't find out about this product until the buggy looked like I'd run over the milkman, so I can't vouch for it keeping new panels looking

new, but it sure works like magic in taking the milky look out of the old."

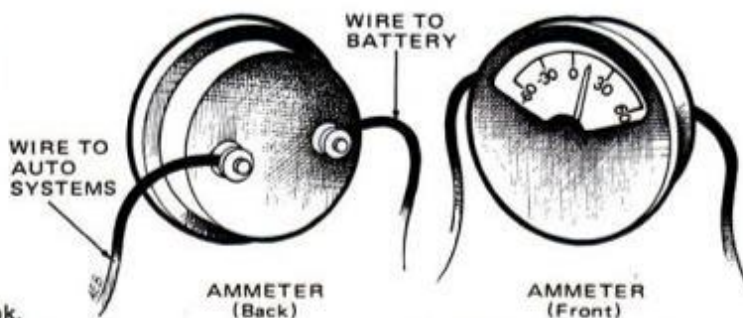
□ Scott Wingerter, Fort Lauderdale, Fla.—"Scrub good with a brush and Comet. Rinse. Wet-sand panels with 320 or 400 paper, paying particular attention to the milky areas. Dry well. Mask trim and door handles. Spray two medium coats of Varathane Liquid Plastic over the panels. This treatment will last two to three years."

□ Mrs. Harold Kunkle, Oak Harbor, Wash.—"Try Old English fur-



Terminal case

Engine won't crank, horn is silent, headlights out—must be a dead battery, right? Not necessarily. A faulty ammeter or ammeter connection can cause these symptoms. The car's systems are dead because all supply current (except cranking) must flow through the "series connected" ammeter. Any defect cuts the supply at the source. The car can be cranked by bridging the starter solenoid with a screwdriver, but will not run; without power to the ignition coil there is no spark at the plugs.



A dirty carburetor can be a real problem.



This can be a real help.

Meet STP Carburetor Cleaner. A spray. Its needlenose can get into tough places—to help clean throttle plate, choke, linkage, and the PCV valve. The varnish and gum can actually dissolve before your eyes. STP Carburetor Cleaner. Could be what you need. Right now.

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niture polish. It works like a dream. I put it on after I wash and polish the car, or when panels need it. Rub it in well."

□ Jim Wachob, San Diego, Calif.—"I discovered that Lemon Pledge not only restored the paneling of my 1975 Chrysler Town and Country wagon, but improved the luster."

□ Charles F. Huetger, Alexandria, Va.—"Try marine varnish."

□ Wayne Murray, East Syracuse, N.Y.—"Using 000 steel wool once a year to scrub panels is all that's necessary."

□ Mal Fuller, Wolfeboro, N.H.—"The answer is Pizzazz by Permatex Co."

So, never again should I get a letter about the milky-panel problem. Heap smart, no?

Main bout

Almost from the day I bought my 1976 Ford 150 pickup (six-cylinder, 300-cu.-in. engine), I've been having starting problems. The engine acts as if the battery is weak, but it is hot as fire and the cables are perfect. The dealer has put on three new starters, two starter relays, starter drive, ring gear, alternator and voltage regulator. I'm at my wits end. Please,

can you offer any suggestions?—C.F. Hopkins, Brazoria, Tex.

Refer your dealer to article 1468, service bulletin 111 (5/6/77): "Hard starting with slow cranking speeds, starting motor 'stall' and high amp. draw can be caused by the spark at the sparkplug occurring too early, resulting in the engine 'fighting' the starter." The starting problem affects all 1976 Ford and Lincoln-Mercury passenger cars and 1976 trucks, except for diesels.

Causes include a starting system defect (discounted in your case), incorrect basic ignition timing, interference of the seat-belt or key-warning buzzer with solid state ignition module operation, or an internally grounded solid state ignition module.

SERVICE TIPS

■ General Motors advises—strongly—that if you have a windshield or backlite replacer, urethane adhesive caulking kit No. 9631000 be used. The company states, "Squeaks and rattles can develop in vehicles where a large glass such as a windshield or back window is not securely bonded to the body opening with material of the proper design strength."

■ Owners of 1977 Dodge motor homes, compacts and trucks with the heavy-duty cycle 360-1 engine will be happy to learn that there is a cure for cold engine stalling and hesitation. The cure comes in the form of service package 4131057, which includes a new carburetor, choke assembly, speed switch, distributor vacuum advance and other goodies. The "fix" applies to federal and Canadian engines in vehicles of over 6000 lbs. GVW (gross vehicle weight). Service bulletin 14-23A-77 (revision of 12/5/77) lays it all out.

■ A high temperature-gauge reading in your 1978 Ford Fiesta may be deceiving. It doesn't necessarily mean overheating. In fact, a new gauge went into production in January 1978, because the old one was scaring the pants off some Fiesta owners. If you have a pre-'78 Fiesta with a high-reading gauge, your Ford dealer can fix it for you by inserting a 2.50- or 3.30-ohm 1-watt resistor in the sending wire, once proper cooling system functioning is verified. Ford bulletin 146 (11/4/77) spells it out. **PM**

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

SCIENCE WORLDWIDE

Humidifier can make you sick

So far as health goes, the home humidifier is beneficial. But if not given proper care, it may cause respiratory illness. That warning comes in a report in a recent issue of the *Journal of the American Medical Assn.*

The authors—physicians at Boston University School of Medicine—explain that water in humidifiers becomes contaminated by plant and airborne organisms that can cause a respiratory problem known as allergic alveolitis, or hypersensitivity pneumonia. Symptoms include fever, headache, nausea and shortness of breath. In most cases, symptoms are mild and can be mistaken for a slight cold; they disappear at the end of the humidification season—which usually coincides with the heating season. In extreme cases a victim will suffer severe shortness of breath and be unable to perform light tasks such as routine housework. There'll also be weight loss due to loss of appetite. The problem exists mostly in northern climates with long heating seasons.

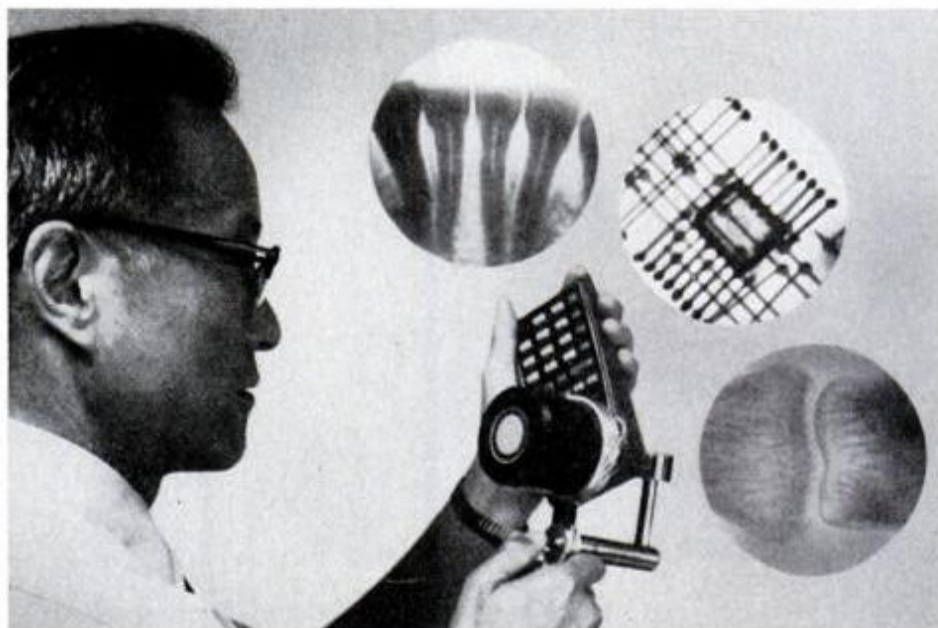
Prevention is simple. Change the water in your humidifier tank and clean the tank with detergent once a week. For units built into furnaces, also change filter screens frequently.

Cooking with kelp?

Seaweed, acted upon by microorganisms, may someday heat your house and cook your food. Investigating plant sources of natural gas, scientists are zeroing in on California brown giant kelp, selected because of its large size, rapid growth (two or more feet per day) and its regenerative capacity after being harvested.

The program initially involves relocating kelp from near-shore locations to an artificial marine farm about five miles off the coast of Southern California, away from fishing and recreational boating areas. The plants will be attached to floats anchored 60 to 80 feet below the surface. Water rich in growth-inducing nutrients will be pumped, or "upwelled," through the plants.

In the fuel production part of the program, emphasis is on a biological process by which certain microorganisms digest harvested kelp and produce gas. Byproducts



Dr. Lin's Lixiscope produced images shown: incisor teeth, circuitry, finger joint.

can be used for fertilizer and livestock feed.

The research program is sponsored by the American Gas Assn. and managed by General Electric.

Revolutionary X-ray device

A new hand-held X-ray instrument may permit on-the-spot emergency medical exams. Developed by Dr. Lo I Yin, a researcher at NASA's Goddard Space Flight Center, Greenbelt, Md., it's called a Lixiscope (for Low Intensity X-ray Imaging Scope).

Pulling a trigger unshields a small radioactive source, sending a low dose of X-rays into the object being examined. The X-rays pass through the object and are absorbed by a phosphor screen that converts them to visible light. An image intensifier, originally developed by the Army, is also part of the system.

Potential applications range from an on-the-field examination of potentially serious sports injuries to the detection of welding defects or gas leaks in pipes. Permanent pictures can quickly be made by attaching a camera. Although the device is not yet on the market, it's estimated that production units could cost less than \$5000.

New world under Antarctica

Scientists using a gas-jet drill recently cut through Antarctica's Ross Ice Shelf, going down some 1240 feet to open up an undersea

world never before seen by man. They reported finding fish and other "signs of life in the form of tracks, trails and burrows."

Some scientists think the frigid, lightless world under the ice might harbor organisms that have evolved into unique life forms because their environment has been isolated from sunlight and the atmosphere for thousands of years. In addition to U.S. researchers, scientists from five other nations are working on the project.

More earthquake research

Earthquake research by the U.S. Geological Survey will more than double during the current budget year, according to the Dept. of the Interior. The expanded program will focus research on three major areas: the development of earthquake prediction techniques; the evaluation of the potential of large water reservoirs to trigger earthquakes; the evaluation of hazards

(Please turn to page 74)



WHEN IT RAINS IT SHINES.



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and risks in earthquake-prone areas like Alaska and Hawaii.

A break for football knees

Knee-level blocking in college football should be outlawed. That's the contention of Thomas R. Peterson, M.D., a University of Michigan surgeon who played on the university's '47 Rose Bowl team and who has studied hundreds of football-related knee injuries.

"I believe we have a responsibility to try to reduce football injuries where causes are known," says Dr. Peterson. "Despite rule changes in recent years, the problem of knee injuries persists."

Dr. Peterson compares the effect of cross-body blocking at or below the knee to thrusting a railroad tie against the unsupported joint. "Cutting down or upending a player with a blind-side cross-body block may be dramatic and exciting to the football fan," he observes, "but the risk of permanent injury is hardly a fair price for such transient thrills."

Would outlawing below-the-knee blocking "spoil" the game? Dr. Peterson doubts that fans would even notice the change, just as he doubts their awareness of a 1974 rules change prohibiting blocking below the waist on kickoffs and punts.

"Our objective should be to eliminate unnecessary hazards to players, especially in the presence of convincing evidence of the causes of such hazards," declares the doctor.

End to supply of lab monkeys

A shortage of rhesus monkeys may soon cause trouble for American medical scientists and vaccine producers. India, the world's largest supplier of the animals, will halt shipments to the United States this month because of alleged violations of an agreement.

In a 1955 accord between the United States and India, weapons research with the monkeys is specifically prohibited. It has been claimed that some rhesus monkeys were used for weapons research by the Armed Forces Radiobiology Research Institute, according to Dr. Richard Dukelow, director of Michigan State University's endocrinology research unit.

"For certain research on human aging, diabetes, malaria and human reproduction," Dr. Dukelow explains, "monkeys are often the best animals to work with and the rhesus monkey is the most popular."

Salk polio vaccine is made only from rhesus kidney tissue.

The United States imports about 12,000 of the monkeys annually. "We now have some rhesus breeding colonies in the U.S.," says Dr. Dukelow, "and there are other species of monkeys that could, in some circumstances, be used as substitutes."

One thing is certain: The price of rhesus monkeys is bound to go up. Currently, a rhesus costs between \$200 and \$450.

Researchers are becoming wiser in their care and use of monkeys and this has caused a drop in imports in recent years, according to Dr. Dukelow. The average monkey in a biomedical colony is healthier and lives longer than his wild counterpart, the researcher maintains, adding that some rhesus monkeys in labs have lived more than 50 years.

Air Force monitors the sun

The Air Force plans to keep a close watch on the sun in order to spot solar flares that mess up the Earth's ionosphere. To do the job, the Air Force is setting up the Solar Observing Optical Network (SOON), with telescopes in New Mexico, Puerto Rico, Australia and Hawaii. The New Mexico and Hawaii scopes are already in position. The system will be operated by the USAF Air Weather Service.

"Solar flares produce major outbursts of energy," says Maj. Virgil H. Webb, a SOON program manager. "They can shower the Earth's atmosphere with high-energy radiation, and this particle rainfall can be particularly heavy in the Earth's polar regions. Solar flares often trigger other natural phenomena that can greatly affect the ionosphere. The northern lights, known as auroras, are the result of such events."

The auroras often create trouble for Air Force systems that depend on stable ionospheric conditions. Signal interference with radar, radio, satellite and surveillance systems can accompany the shooting rays of light. Optical sightings serve as a "barometer" of solar events. Trained Air Force personnel, who measure the sun's brightness with the telescope system, will predict as well as determine the size and location of solar flares.

A good nose for gas leaks

The sensitive nose of a trained dog could do a better job of finding leaks in natural gas pipelines than instruments now in use, according to Dr. Charles S. Feldstone of the

Southwest Research Institute, San Antonio, Tex., where a dog-training program is underway.

The feasibility of using a dog for this purpose has been clearly demonstrated, says the psychologist. He foresees the future use of man-dog teams for gas-leak searches of urban gas distribution systems as well as along the lonely miles of a pipeline walker's route.

A major advantage is that a dog, unlike detector instruments, can discriminate between pipeline-quality gas and the scents of other types of hydrocarbons that may confuse a gas-leak search. When it comes to sniffing out gas, according to Dr. Feldstone, dogs are probably more sensitive than even the most sensitive of detection instruments. And unlike an instrument, a dog can search about at distances up to 50 yards from his handler in running down the source of a leak.

The researcher maintains that experience in other animal training programs has shown that dogs can be trained to detect odors and to ignore distractions.

India's monsoons from Africa?

Heavy rains in India that periodically disrupt that country's economy might be related to fluctuations in very strong, low-level winds over Kenya, Africa. That's the thinking of scientists involved in a preliminary international study of monsoons—the forerunner of a more extensive investigation, the Monsoon Experiment (MONEX), scheduled for 1979.

The scientists say that by monitoring the African winds, it might be possible to predict the timing and intensity of the Indian rains. The agricultural economies of India and countries in East Africa are closely tied to monsoon activity.

One monsoon researcher, Dr. John E. Hart, associate professor of astro-geophysics at the University of Colorado, says data indicate that humid air originating over the southern Indian Ocean crosses the equator on an intense jet stream that flows along the eastern slopes of the Kenyan highlands. From there the jet turns northeast toward the Indian subcontinent, bringing moisture that turns into rain.

"We are studying detailed measurements of winds, radiation and turbulence to help us predict the structure and fluctuations of the jet stream," explains Dr. Hart. "These are thought to be related to surges in rainfall over India, and suggest the possibility of using the jet as a predictor for monsoon surges."

PM

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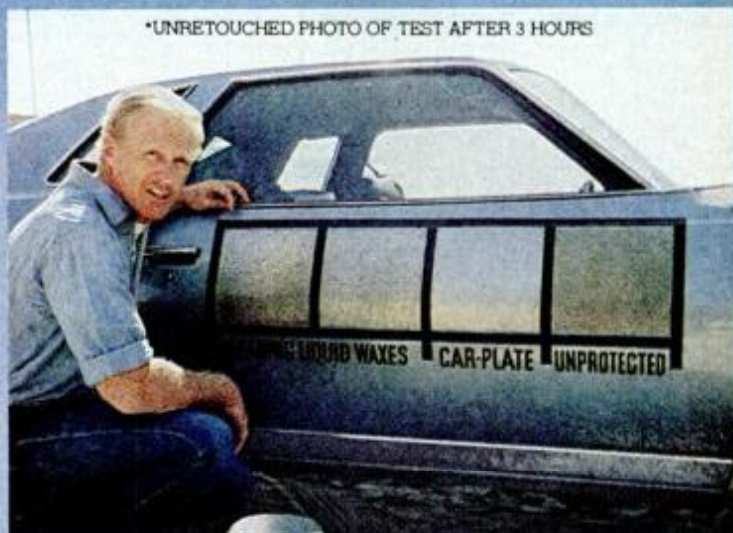
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*UNRETOUCHED PHOTO OF TEST AFTER 3 HOURS



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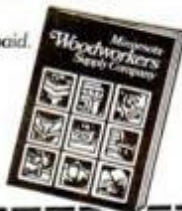
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APPLIANCE CLINIC

(Continued from page 76)

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Appliance Parts Co., Inc., 727 South Gallatin St., Jackson 39207 (601/948-4680).
May Co., Inc., West Capital, Jackson 29205 (601/354-5781).

MISSOURI

Marcone Appliance Parts Center, 2320 Pine St., St. Louis, 63103 (314/231-7141).
St. Louis Appliance Parts, Inc., 2911-13 South Jefferson St., St. Louis 63118 (314/776-1445).

Washer Equipment Co., 1715 Main St., Kansas City 64108 (816/842-3911).

NEBRASKA

Lincoln Appliance Parts Supply, Inc., 728 South 27th St., Lincoln 68510 (402/432-6908).

NEVADA

Electrical Appliance Co., Kuenzli St., Reno 89501 (702/786-0210).

NEW HAMPSHIRE

Gene's Appliance Parts, Inc., 58 1/2 Kinsley St., Nashua 03060 (603/889-5331).

NEW JERSEY

Jacoby Appliance Parts Co., 269 Main St., Hackensack 07601 (201/489-6444); 65 Albany St., New Brunswick 08901 (201/846-0300); 1242 Springfield Ave., Irvington 07111 (201/371-8800); 923 North Olden, Trenton 08609 (609/392-6051).

Westchester Appliance Parts, Inc., 197 State Highway 17, Paramus 07652 (201/261-2500).

Rex Electric Supply Co., 1034 Clinton Ave., Irvington 07111 (201/399-0111).

All Brand Appliance Parts, Inc., 12 West Kings Highway, Mt. Ephraim 08059 (609/933-2300).

Macco Electrical and Appliance Parts Co., 800 South Egg Harbor Rd., Hammonton 08037 (609/561-7270).

Pyramid Supply Co., 1707 New York Ave., Union City 07087 (201/866-3900).

Valley Appliance Parts Co., 754 Hamburg Turnpike, Wayne 07470 (201/835-2157).

NEW MEXICO

Akrit Appliance Supply Co., 526 Washington N.E., Albuquerque 87108 (505/345-8651).

NEW YORK

All Appliance Parts of New York, Inc., 1985 New York Ave., Huntington Station 11746 (516/427-4600); 2580 Sunrise Highway, Bellmore 11710 (516/221-6660).

Westchester Appliance Parts, Inc., 1034 Yonkers Ave., Yonkers 10704 (914/237-0500).

Richmond Distributors, Inc., 1452 Myrtle Ave., Brooklyn 11237 (212/455-3079).

Ardco Supply Co., 125 West Main St., Endicott 13760 (607/754-6706).

Alan Appliance Parts Co., 184 Old Country Rd., Hicksville 11801 (516/681-3535).

NORTH CAROLINA

D and L Appliance Co., 708 South Mint St., Charlotte 28201 (704/374-0400).

Moore and Stewart Appliance Parts, Inc., 316 East Franklin Ave., Gastonia 28053 (704/864-8334).

Appliance Parts Co., Inc., 612 Person St., Fayetteville 28301 (919/483-4700).

Cashwell Appliance Parts, Inc., Yadkin Rd., Fayetteville 28303 (919/867-1135).

Morton Distributing Co., Inc., Asheville 28806 (704/258-2223).

OHIO

American Electric Washer Co., 1834 East 55th St., Cleveland 44103 (216/431-4400); 405 East Market St., Akron 44309 (216/535-2648).

Appliance Parts Supply Co., 235 Broadway St., Toledo 43602 (419/244-6741).

Dayton Appliance Parts Co., 122 Sears St., Dayton 45402 (513/224-3531).

Brand Service Center, 808 Elm St., Cincinnati 45202 (513/241-3701).

Mason Supply Co., 985 Joyce Ave., Columbus 43203 (614/253-8607); Apple St., Cincinnati 45202 (513/591-0020).

Pearson Appliance Corp., 2319 Gilbert St., Cincinnati 45206 (513/221-1195).

Pearson Corp. of Ohio, 1847 East 40th St., Cleveland 44103 (216/881-5085).

Shore Appliance Co., 17630, South Waterloo Rd., Cleveland 44110 (216/481-1790); 6573 Pearl Rd., Parma Heights 44130 (216/888-4646).

Stone's Appliance Co., 7580 Mentor Ave., Mentor 44060 (216/951-2775).

OKLAHOMA

Greer Electric Co., 1018 South Rockford, Tulsa 74104 (918/587-3346).

Pritchard Electric Co., Inc., 3100 North Santa Fe, Oklahoma City 73101 (405/528-0592).

OREGON

W.L. May Co., Inc., 235 Northwest Park Ave., Portland 97209 (503/231-7000); 3619 Franklin Blvd., Eugene 97403 (503/726-7696).

Pacific Appliance Parts, Inc., 835 East Burnside, Portland 97214 (503/238-6311).

Appliance Parts Co., 1009 Southeast Lincoln Blvd., Portland 97215 (503/236-1109).

PENNSYLVANIA

Collins Appliance Parts, Inc., 1533 Metropolitan St., Pittsburgh 15233 (412/321-3700).

All Appliance Parts Co., 5023 Penn Ave., Pittsburgh 15224 (412/362-1500).

Kohler Appliance Parts Supply, Inc., 201 Lexington Ave., Altoona 16601 (814/943-8137).

Wagner Appliance Parts, Inc., 1814 Tilghman St., Allentown 18104 (215/439-1564).

McCombs Supply Co., 259 South Ann St., Lancaster 17602 (717/299-3866).

McKeesport Appliance Parts Co., 434 Shaw Ave., McKeesport 15132 (412/678-1300).

Scranton Appliance Parts Co., 830 Capouse Ave., Scranton 18500 (717/347-2211).

D.J. Hurley Co., 18 West Chester Pike, Havertown 19083 (215/446-8894).

PUERTO RICO

Appliance Parts Corp., 1207 Roosevelt Ave., Puerto Nuevo 00920 (809/783-4195).

J.A. Diaz and Co., 1316 San Alfonso St., Rio Piedras 00921 (809/783-4656).

RHODE ISLAND

Appliance Parts Co., Inc., 316 Cranston St., Providence 02907 (401/421-6142).

Anderberg's Appliance Parts Co., 855 North Main St., Providence 02904 (401/351-4361).

SOUTH CAROLINA

G and E Parts Center, Inc., 852 Pine St., Spartanburg 29302 (803/585-6277); 1212 Bluff Rd., Columbia 29202 (803/771-4346).

Harris Appliance Parts Co., Greenville 29606 (803/233-3977).

Appliance Parts Co., 1907 Huger St., Columbia 29201 (803/252-9047).

Harris Appliance Parts Co., Anderson 29621 (803/224-6720).

TENNESSEE

Brown Appliance Parts Co., Inc., 857 North Central Ave., Knoxville 37917 (615/525-9363); 1813 East 23rd St., Chattanooga 37401 (615/624-7608); 1706 State St., Bristol 37620 (615/968-3138).

Curtis Appliance Parts Co., 562 East St., Memphis 38104 (901/527-1611).

Appliance Parts Co., Second St., Nashville 37213 (615/242-5597).

Hamilton Appliance Parts Co., 801 Magnolia Ave., Knoxville 37917 (615/525-0418).

Appliance Parts Warehouse, Inc., 2311 East 23rd St., Chattanooga 37408 (615/698-1731).

TEXAS

Pearson Appliance Co., 3127 Main St., Dallas, 75226 (214/741-4638).

Standard Appliance Parts Corp., 4814 Ayers St., Corpus Christi 78415 (512/853-9823).

Central Supply Co., McKinney St., Houston 77001 (713/224-8491); 5475 College St., Beaumont 77705 (713/842-3899).

Washing Machine Parts Co., 704 North Main St., Fort Worth 76106 (817/332-5343); 3314 Ross Ave., Dallas 75221 (214/827-1023); South St. Mary's, San Antonio 78206 (512/225-2717).

Alitex Appliance Co., 2710 Fielder Court, Dallas 75235 (214/358-4681).

Stove Parts Supply Co., 2120 Solana St., Fort Worth 76107 (817/831-0381).

Nelson's Specialty Supply Co., East Seventh St., Austin 78702 (512/478-6468).

Akrit Appliance Supply Co., 1805 Montana, El Paso 79902 (915/544-3350); 2306 19th St., Lubbock 79401 (806/763-5282).

Brey Washing Machine Parts Co., 1920 North Piedras, El Paso 79930 (915/565-3982).

UTAH

Iasco Distributing Co., 925 Southwest Temple St., Salt Lake City 84101 (801/328-0505).

VIRGINIA

Refrigeration Supply Co., Inc., 1221 Admiral St., Richmond 23220 (804/649-1271).

Booth Supply Co., Inc., 2621 Florida Ave., Norfolk 23501 (804/857-1229); 828 Jamison Ave. S.E., Roanoke 24001 (703/344-2083).

Wholesale Parts Distributors, Inc., Lance Rd., Norfolk 23510 (804/461-3888).

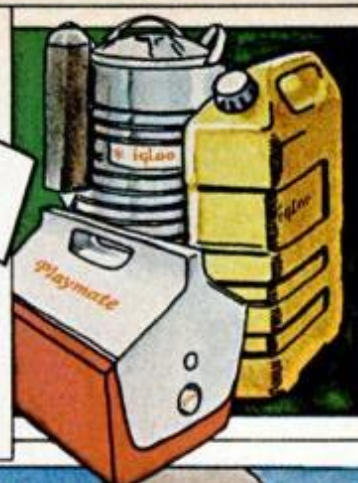
Tribble's, Inc., 7263 Arlington Blvd., Falls Church 22042 (703/573-1000).

(Please turn to page 200)



IGLOO'S TRUE STORIES OF SURVIVAL

• THE TOLEDO BEND INCIDENT •



1. LATE AFTERNOON, TOLEDO BEND LAKE. W.J. BURRIS AND HIS SON, FROM WEST MONROE, LA., WERE AT McDONALD'S LANDING, PACKING THEIR BASS FISHING GEAR.



2. WHEN SUDDENLY... "HELP! HELP!" THEY HEARD FAINT CRIES UPWIND.



3. THEY LAUNCHED THEIR BOAT, AND AS THE SUNSET CLOSED IN, THEY SAW THEM...

4. TWO FISHERMEN, STRUGGLING IN THE WATER, HANGING ON TO AN IGLOO ICE CHEST.

DURING A SUDDEN STORM, THE FISHERMEN'S METAL BOAT HAD HIT A STUMP AND SUNK WITHIN MINUTES. AND WITH IT, THEIR FLOTATION GEAR.



5. THE ONLY THING THAT HAD STOOD BETWEEN THEM AND THE BOTTOM OF THE LAKE WAS THE IGLOO, STILL LOADED DOWN WITH FOOD.

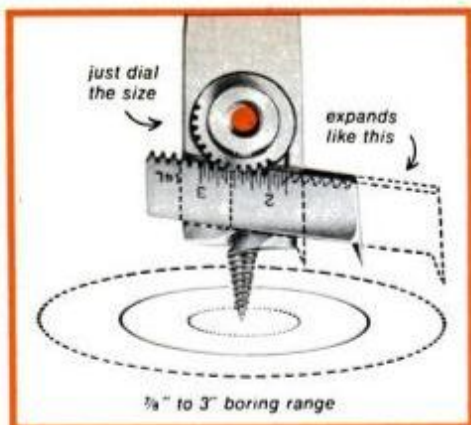
6. AFTER HEARING THEIR STORY, W.J. BURRIS WAS SOLD ON IGLOO. HE HAD SEEN THAT IGLOO ICE CHESTS NOT ONLY HOLD UP TO EVERYDAY USE, BUT HAD HELD UP 300 EXTRA POUNDS IN THE MIDDLE OF A TREACHEROUS LAKE. PROOF, ONCE AGAIN, THAT IGLOOS ARE BUILT TO SURVIVE THE REAL WORLD. THE ONLY ICE CHEST BUILT TOUGH ENOUGH TO CARRY A FULL 3-YEAR WARRANTY.



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IT'S NEW
NOW

New hedgehopper

With a 300-hp engine and 280-gallon hopper, the 1978 model of Cessna's AGtruck handles a wide variety of spraying operations. Ship's exceptional maneuverability allows the pilot to follow planting patterns. With spray gear, aircraft weighs 2234 pounds, cruises at 121 mph, is \$49,650.



For budding Robin Hoods

Straw compacted under high pressure and temperature makes the Tomo an unusually durable archery target, says British maker. It will sell here for about \$25.

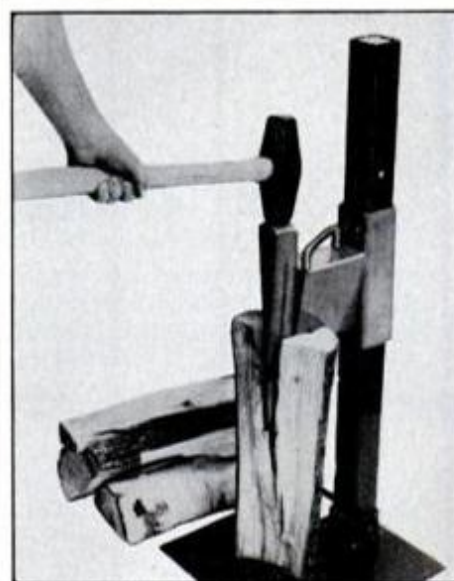
Which way is Piccadilly?

Student drivers in London can rent Static Steer to practice driving at home. By adjusting tension, student gets the feel of driving everything from a Rolls Royce to a mini car.



Pocket-sized movie camera

Billed as the world's smallest Super-8, the \$149.95 Chinon Pocket-8 measures only 5½ by 3½ inches, weighs 15.9 ounces. It has advanced features like automatic through-lens exposure control.



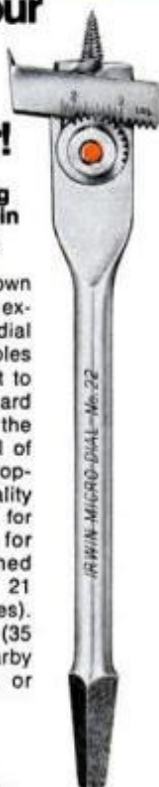
No-tip log splitting

Place log against Jiffy Woodsplitter's mast, lower wedge, smack it with sledge. Priced at \$89.95. C&D Distributors, Box 766-P, Old Saybrook, Conn. 06475.

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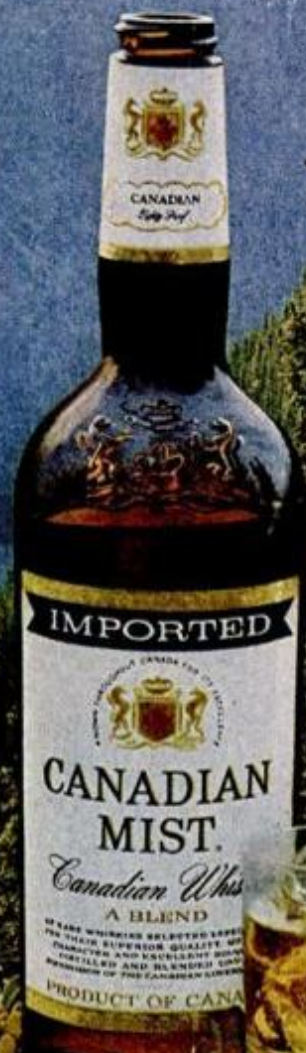


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Come to Marlboro Country.

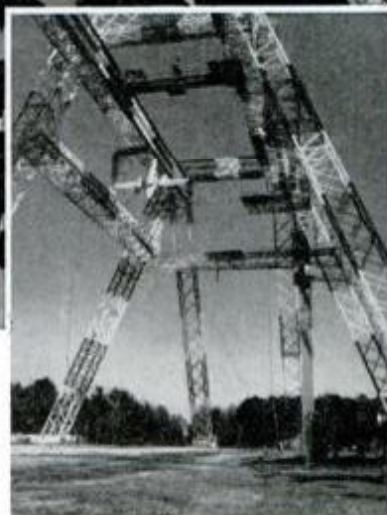
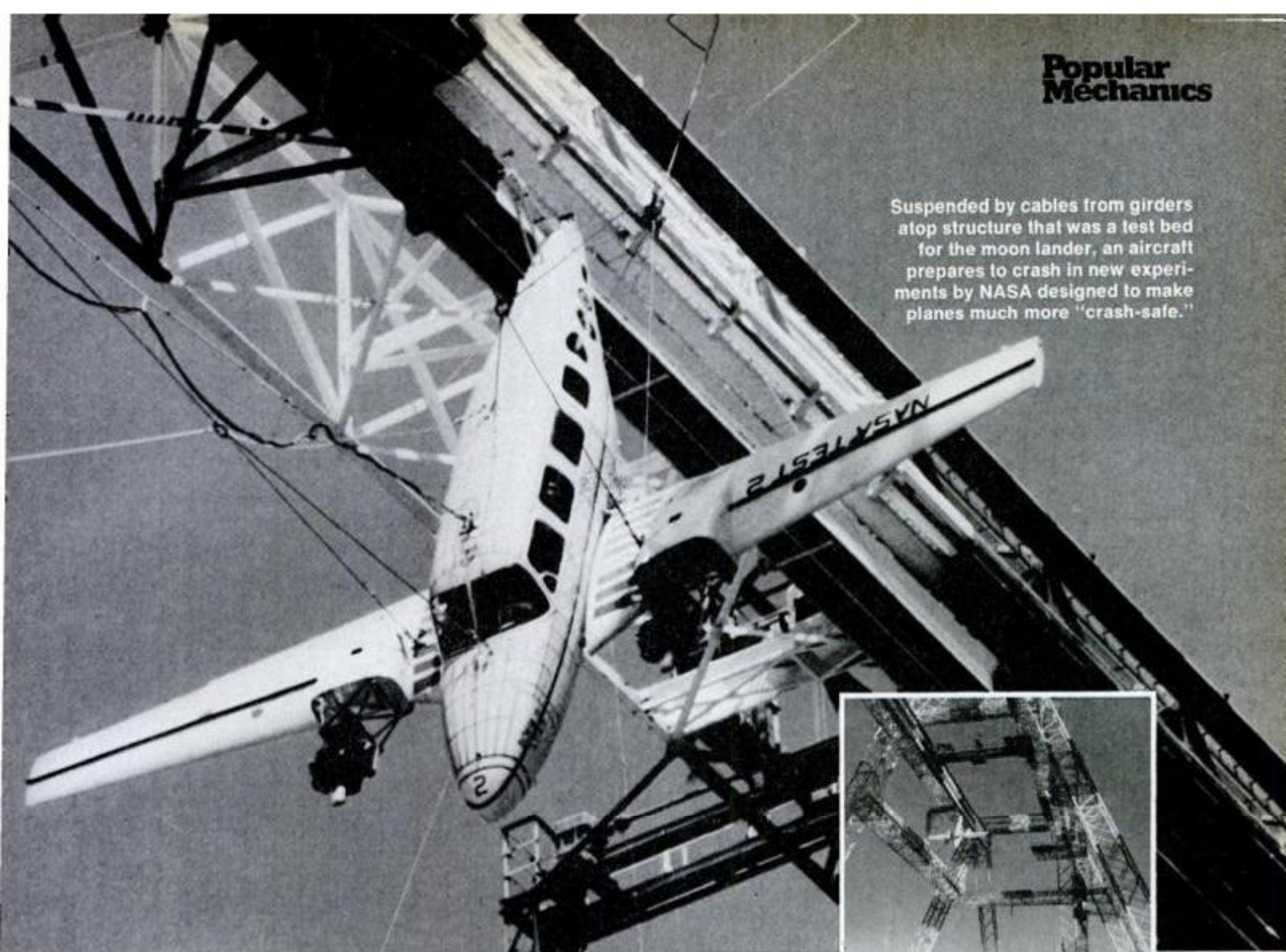
Marlboro Red or Longhorn 100's—
you get a lot to like.



Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

17 mg "tar," 1.0 mg nicotine av. per cigarette. FTC Report Aug. 77.

Suspended by cables from girders atop structure that was a test bed for the moon lander, an aircraft prepares to crash in new experiments by NASA designed to make planes much more "crash-safe."



Researchers are 'flying' real airplanes into the ground and setting airliners on fire to see what happens to craft and passengers in crashes. Object: to improve your chances of survival in a crackup.

TARGET: A SAFER PLANE TO CRASH IN

by Richard F. Dempewolf

Out on the apron, a bright yellow twin-engine plane had already been readied for takeoff when I arrived at NASA's Langley Research Center in Hampton, Va. Through the craft's windows, profiles of the pilot and several passengers were clearly visible. According to the unique flight plan, all of them were destined to be victims of a spine-shattering crash landing on a concrete apron at 90 mph.

Some would "die"; others might "survive." Each—along with the aircraft itself—would contribute valuable data to a growing body of knowledge about what happens to people and planes in actual crashes—and what can be done to make aircraft safer to crash in.

As it turned out, the scheduled "crash-of-the-day" was postponed. Wind and weather didn't cooperate. But for two days I prowled and ex-

plored the fantastic complex of this Bunyanesque facility, lately assigned to a joint NASA/Federal Aviation Administration (FAA) investigation of aircraft "crash-worthiness," using full-scale aircraft—most of them brand-new.

The central arena for the spectacular "shows" performed here is a gigantic, spidery gantry of red-and-white steel trusses, resembling the spraddle-legged frame of a back-

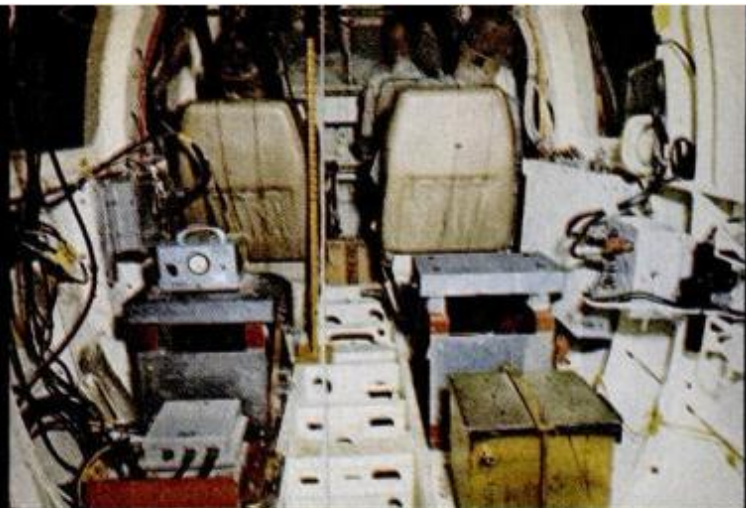


Slammed against concrete at a 45° angle, the aircraft shown in this series of crash-test pictures dramatically reveals how the initial impact is followed closely by a secondary impact as the plane's fuselage whips down. Note in the second and third frames how the cabin completely deforms, then reforms itself as fuselage flattens on the ground (fourth frame). The photos were taken at intervals of hundredths of a second at NASA's Langley Research Center in Virginia.



yard swing for a family of giants. The vast affair—400 feet long and 240 feet high—is supported by three sets of legs slanting 267 feet apart. It was originally designed as a test bed for the Apollo moon lander. Suspended beneath the huge structure's great spine by winched cables that nullified five-sixths of Earth's gravity, the LEM and its astronauts were able to simulate actual lunar landings.

Today the facility has been modified to take full-scale aircraft suspended beneath it on a web of cables that determine their precise attitude at impact. The length of the swing cable controls the angle at

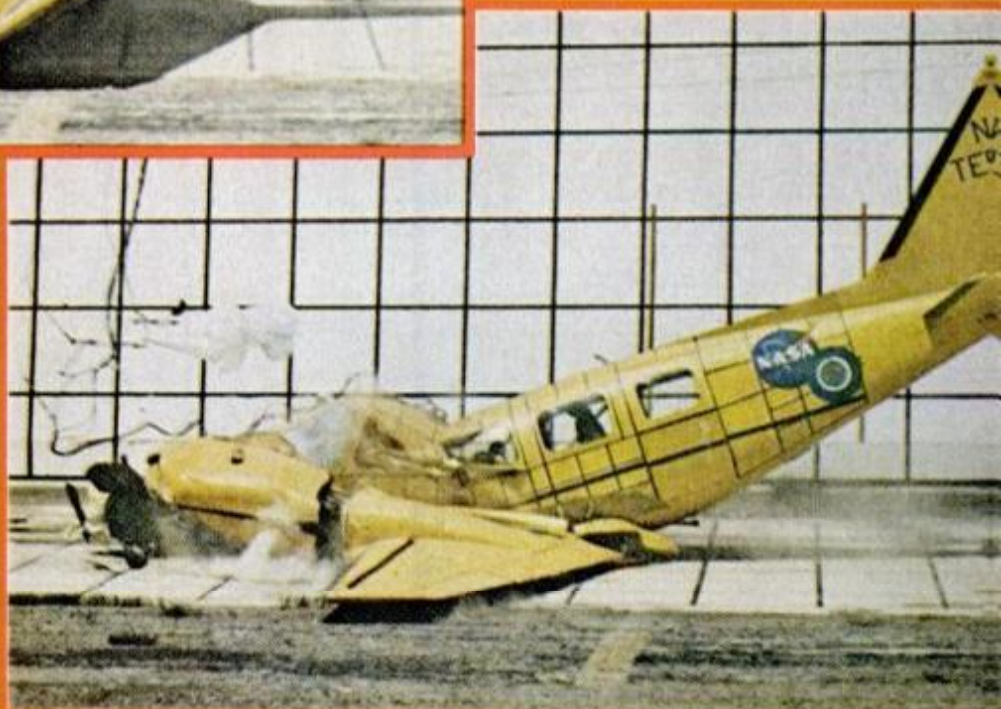


Interior of plane before test. Dummies are belted in seats. Note monitoring devices in foreground to measure impact.

which a plane will crash. Flight paths can be rigged for up to 60°. Cables secured to the wings adjust for roll and yaw attitudes. Release height of a plane determines its impact speed, which can be adjusted up to 60 mph, using gravity alone. The 90-mph *splat* I saw being readied would get a special push from a small jet engine.

Countdown to doom

With everything in readiness, the doomed plane—complete with “passengers,” water in its fuel tanks and ballast to provide a near-normal flight weight of 6000 pounds—is swung upward to the high girders by a pull-back cable. There it dangles like a toy, pitching gently in the breeze to the accompaniment of a PA system countdown reminiscent of Cape Kennedy moon-shot days: “Thirty seconds and counting,” a

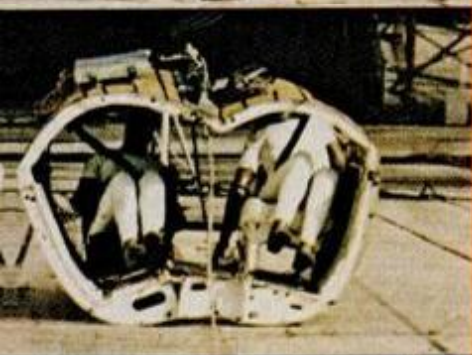
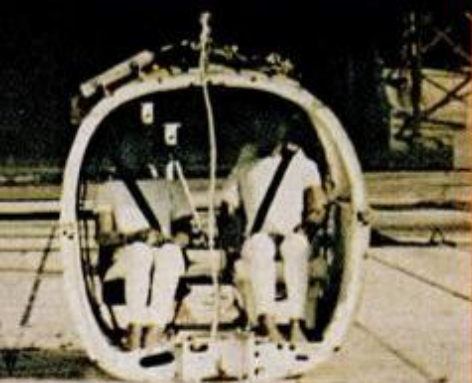




Interior of same plane following crash shows failure of cabin containment and battered condition of dummy passengers.



Vertical impact forces cause what the experts call "submarining"—shoving passenger down, under and out of his lap belt.



At the National Aviation Facilities Experimental Center (NAFEC), in New Jersey, researchers acquired this C-133 (above) "for burning." Fire tests are aimed at making commercial carriers more fire-safe. This dramatic work is described on page 87.

Drop test of a fuselage section at NASA Langley's facility illustrates how, in secondary vertical impact, cabin deforms, floor heaves in center, dislodging seats and dummy passengers, then recovers somewhat. Note how cabin roof has collapsed onto passengers' heads in center photo, cracking skulls and breaking necks.

voice echoes across the complex. "Twenty seconds . . . ten seconds . . . nine, eight, seven . . ."

At zero time, the pull-back is released. The test aircraft swoops downward on its suspension cable like a pendulum. One-tenth of a second before contact with the ground, the swing cable is separated by an explosive charge, so the plane is in free flight at impact. Only an umbilical cable, carrying signals from some 150 sensors on board, remains attached as the craft slams into the ground, erupting in a cloud of dust, dirt and flying debris. Sliding 100 or more yards along the ground, the flapping wreck comes to rest against a mesh barrier. The umbilical detaches during the slide-out.

Preserved in the debris is a





New seat configuration developed through the crash tests is known among NASA test crews as "the rocking chair." On impact, the seat collapses down and forward, using any of several systems to absorb energy. But knees remain in same position—no jamming forward.



formidable pile of test information. Eighteen cameras, three of them inside the craft and the rest spotted around the impact area, have recorded every microsecond of the crash, at film speeds ranging from 24 to 2000 frames per second. Accelerometers have measured forces on some 50 structural components and areas of the plane, from instant of impact to slide-out. Instruments on the "passengers" have measured stresses and strains on all critical parts of their bodies.

Violent effects

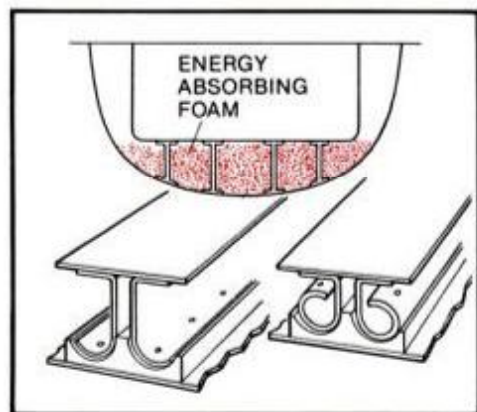
Those are the basics. What happens inside the plane during this violent scenario is the reason for it all. To educate me on highlights of the program, Langley Research Center's crash safety program group leader, Dr. Robert G. Thomson, ran through a half-day short course in airplane crash dynamics.

I watched movies of many of the nearly 20 actual production-line aircraft that already have been deliberately "flown" into the ground and smashed into crumpled heaps. I saw high-speed films—taken inside the planes as they rammed the ground.

I watched decks bulge upward, cabins deform under impact and "passengers" being battered around as their seats were torn loose by the high G-forces.

"Passengers" in these real crash experiments are dummies similar to those used in automotive crash tests. Each one weighs the same as an average living human and is stressed to simulate typical bone and tissue failure characteristics; joints of composite materials are similarly breakable or prone to damage on impact.

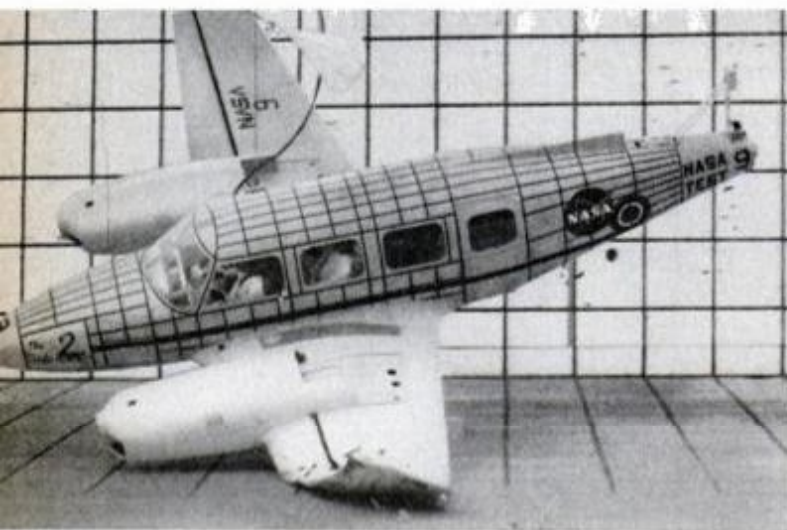
Some dummies have names, ceremoniously bestowed by test crews. A frequent copilot is known as "Ich-



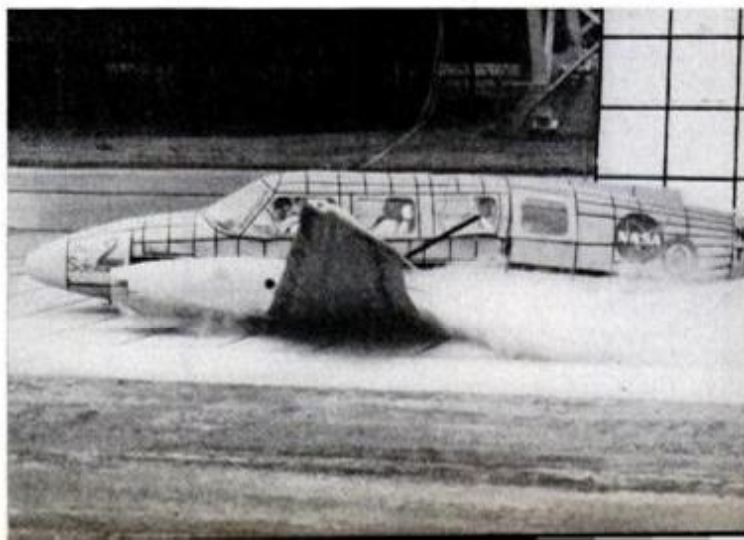
I-beam that absorbs vertical impact energy in aircraft bellies has a double spine that curls up, absorbing crushing G-forces.

abod," after Ichabod Crane in the headless horseman episode of Washington Irving's *Legend of Sleepy Hollow*. He happens to be headless so the automated movie camera

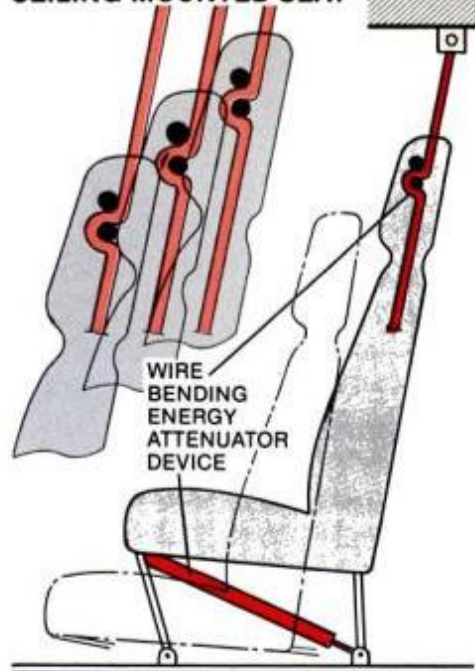
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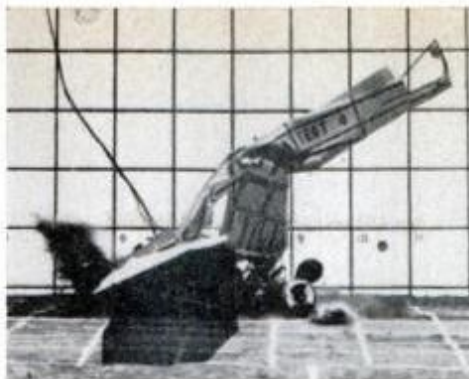
Nose down, port wing low in shallow roll, Test No. 9 came through almost unscathed. Cabin integrity was maintained in crash, and all dummies "survived." Wing took most of shock.



CEILING MOUNTED SEAT



Energy-absorbing seats are top-priority study at Langley. Wire-bending device in back and/or diagonal underpinning can absorb 20 or more Gs in a foot of travel. Seat at left (on facing page) does the same with honeycomb metal cylinders.



FAA crash test at Langley facility dove lightplane into four feet of soil . . .



. . . which you'd think might cushion impact, but nose dug in and the craft . . .



. . . stopped dead at point of impact, folded like an accordion, flipped over . . .



. . . on its back, a total wreck, with no chance of survival for any passengers.

PROJECT 'BURN' FOR FIRE-SAFE PLANES by Mort Schultz



Surplus Air Force C-133 is for burning at FAA's NAFEC facility in Atlantic City, N.J. Old fuselage is used as fire lab to test burning characteristics of materials used in commercial jets. Object: to help make tomorrow's jumbo jets more fire-safe when involved in crash situations.

Federal Aviation Administration (FAA), is civil aviation's most elaborate proving ground, conducting research in many vital air-safety areas from air traffic control to crash survivability.

Can fires so intense that they melt metal be contained? The search for an answer, ironically, was under way at NAFEC long before the Tenerife catastrophe. Researchers there have been deliberately and repeatedly setting a scrapped C-133 military cargo plane ablaze to study the effects of fire on flammable materials in commercial jetliners—specifically, wide-bodied 747s, DC-10s and L-1011s. Cabin size of the C-133 is close to that of a jumbo jet, making it ideal for testing fire-safety techniques and materials for future use. Fires are carefully controlled scenarios. Materials being tested are installed in

(Please turn to page 190)

When two jumbo jets collided on a fog-shrouded runway at Tenerife in the Canary Islands last March, the horrifying disaster became the worst in aviation history. It took 577 lives. Most died not from impact, but from fire or fire-related causes.

Both planes were huge 747s; one operated by KLM, the other by Pan Am. The KLM jet, barely airborne, sliced its right wing into the fuselage of the Pan Am craft, spewing flaming fuel from ruptured wing tanks into the cabin interior. The crippled KLM jumbo then slammed back to earth and exploded into flame itself. All on board, 252 people, died in a fire so intense that aluminum and steel vaporized.

Inside the stricken Pan Am jet, raging fire, along with deadly hydrogen cyanide and carbon monoxide fumes—by-products of burning fabric and plastics—spread rapidly throughout the ship. Of the 406 trapped travelers, 325 perished.

"Had it been possible to contain that fire, most victims of the crash would have survived," claims Wayne D. Howell, chief of the Fire Safety Branch at the National Aviation Facilities Experimental Center (NAFEC) in Atlantic City, N.J. The 5000-acre facility, part of the

Interior of the old transport plane gets an asbestos liner and a built-up deck to conform more closely to the commercial jumbo jets. The wide-bodied C-133's fuselage comes within inches of matching the circumference of the big passenger jet planes, thus making it an ideal test bed to examine the behavior of various materials in fire situations.



Towing the base section on the world's biggest barge to its launch site 15 miles south of the mouth of the Mississippi River in the Gulf of Mexico was a tricky job.

After flooding one end of the barge so it was tilted 3° down, hydraulic jacks raised one end of the base section, causing it to slide off slippery tracks into the water.

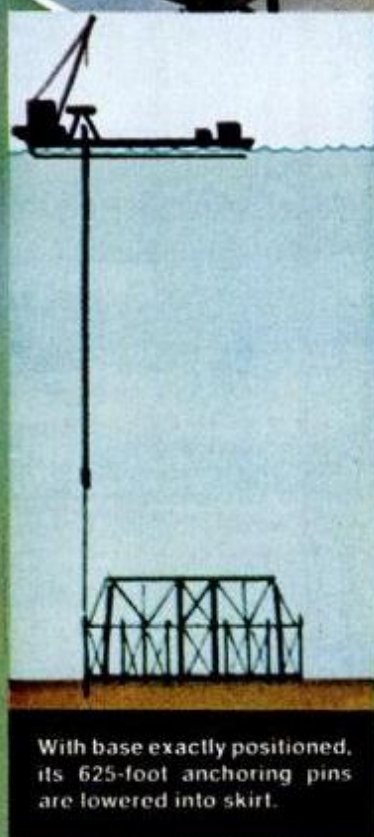


A thousand feet below the floor of the Gulf of Mexico lie 100 million barrels of crude oil. A thousand feet above the floor works a group of men whose dream is to tap that oil.

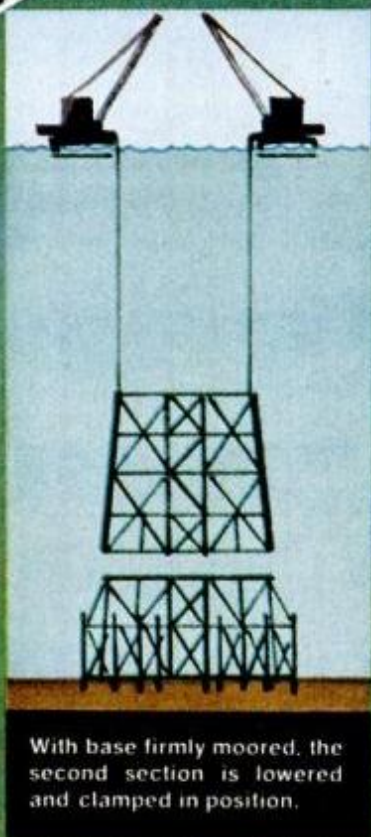
Until now it's been impossible. The technology wasn't there to build a giant offshore drilling platform whose feet would be stuck in clay 1000 feet below the surface. But those times have passed, and oil engineers are stretching the state of their art beyond belief.

Today, a super rig is under construction in unpredictable waters just 15 miles south of the Mississippi River mouth. Soon an amazing 62

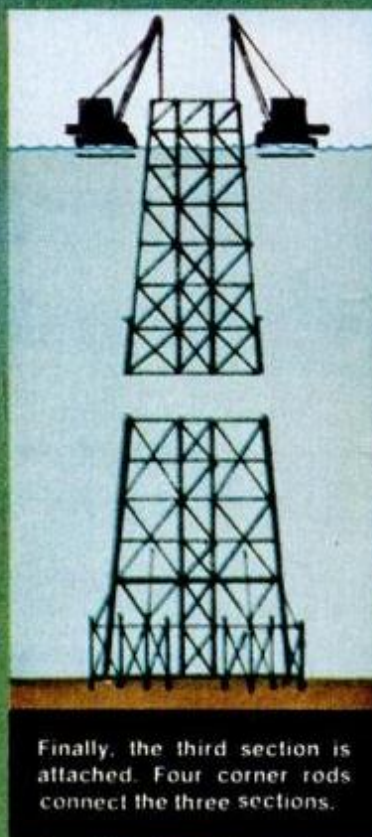
Control panels (left) give positional information from a computer located on the on-site barge. Engineers can operate derricks to position the platform base from control room by following computer displays.



With base exactly positioned, its 625-foot anchoring pins are lowered into skirt.



With base firmly moored, the second section is lowered and clamped in position.



Finally, the third section is attached. Four corner rods connect the three sections.

Cables of steel 3½ inches in diameter were rigged from two derrick barges. Skirt tubes on the base were flooded to a predetermined level to give slight negative buoyancy.

When erected, drilling rigs on the Cognac platform will make its superstructure 15 feet taller than the Empire State Building.

Oil engineers are pushing technology to the limit as they build the world's largest offshore oil platform in 1000 feet of water.

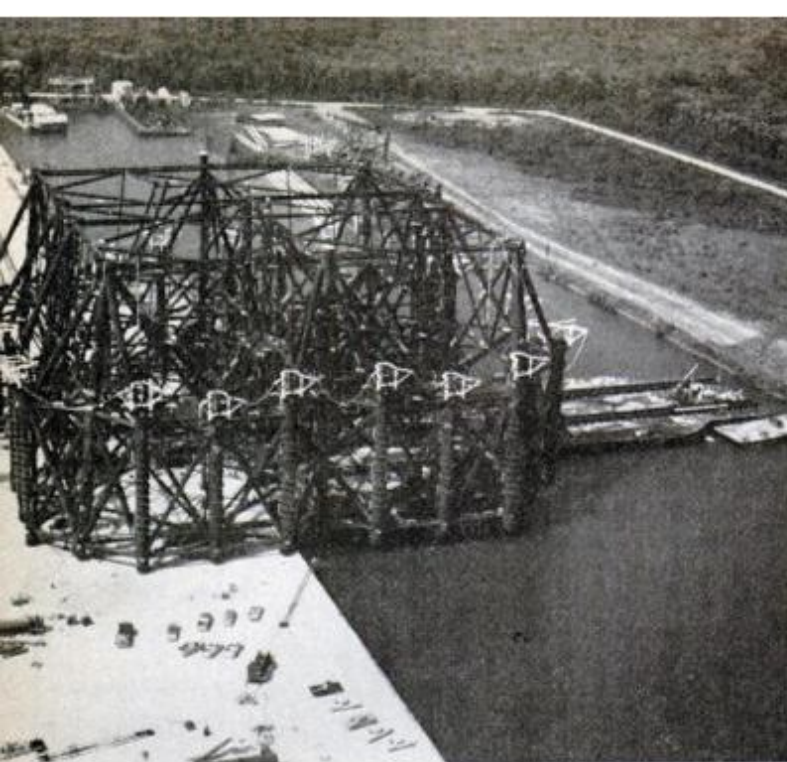
by Dan Fales

HOW OILMEN ARE LAUNCHING

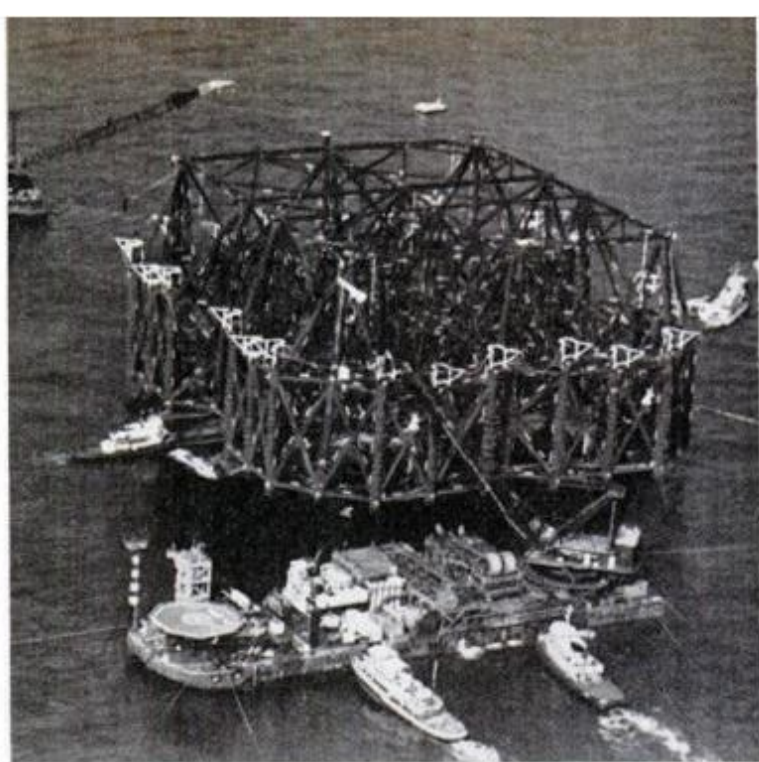
SUPER RIG

More than 60 separate wells will be sunk from the rig to tap gas and oil from the 35-square-mile area.





Cognac platform base section is loaded on mammoth barge that's 450 feet long by 150 feet wide. Note 625-foot anchoring pins lying on ground (upper left). Pins weigh a total of 450 tons.



Base section on site, rigged in a lowering harness between two 500-ton derrick barges. Computer control center is on main barge No. 16 in foreground. Note white "cowcatchers" on skirt.

separate wells will fan out from under one platform like a blossoming flower—and strike oil.

But before that happens a lot of men must do a lot of strange things. Among the strangest is the fact that diving teams must stay cooped up for 39 days, most of them beneath the surface, in small pressurized chambers. And even stranger—they love every minute of it.

"Nine hundred dollars a day is what each diver gets," explains Bob Ferris, a Shell Oil Co. vice-president in charge of seeing to it that an army of scientists, engineers, divers and roustabouts find and tap fields in the oil-rich gulf.

As we stand on Derrick Barge No. 16 anchored on site, I realize the surprising \$900-a-day pay is only one of hundreds of incredible facts that surround the oilmen's latest and most adventuresome offshore construction project. Actually, Shell is sinking the world's tallest oil rig into water that's deeper than any to be found beneath other surface-platform rigs.

Troubled waters

Though the gulf waters may seem docile compared to those of the North Sea or off Alaska—they are not. Only six days apart, two hurricanes forced postponement of my trip to Cognac—Shell's code name for this massive project that will take nine years from start to finish.

When complete, the Cognac tower will sit in 1025 feet of water and rise off the gulf bottom 1265 feet—

Derrick Barge No. 16 (right) is the central campaign headquarters for project Cognac. The barge had to be released from its sophisticated anchoring system twice last fall as two hurricanes approached site, endangering the operation. Each time the barge was towed to protected waters.



some 15 feet taller than New York City's Empire State Building. The structure will also be the heaviest of its kind in the world—weighing 46,000 tons—about the weight of the famous oceanliner *Titanic*.

Most platforms for undersea drilling are built erect and then towed complete to the launch site. Not Cognac. It is the first rig to be built in three sections, each separately towed to the site and launched. Shell engineers are literally putting together a giant Erector Set project of three sections.

Sinking a city block

The first section is the size of a city block. This base unit sits on the gulf bottom. Actually, it's spiked to the bottom by 24 steel pins that are 7 feet in diameter, 625 feet long and have a wall thickness of a whopping three inches.

Just to plant the base section took new techniques and special designs that have stretched the state of the art farther than anyone ever believed possible. To me, just getting the platform located in the general vicinity of the oil field is making



Cognac base section slides off launch barge into the water at a maximum angle of 30°. Greased tracks aided the launching.



Base section floats level and free immediately after the launch. The final lowering preparations required about 36 hours.

engineering a higher art form. But to Sam Paine, Shell's project chief, planting the base section is an exact science. I never realized how exact it is until he told me.

Even before you tow out the first equipment barge, a plan is developed. Shell's plan is to tap the oil that's spotted at various levels below the seafloor over an area covering 36 square miles. To do this, oil engineers decided the economics of an above-sea drilling platform would be best. Deeper water would force them into the more expensive submerge-

drilling techniques. They also decided that with modern drilling technology they needed to construct only one giant platform from which to drill 62 wells.

This number is a record-breaker in itself, yet there's more. Drilling 62 wells straight down does nothing to bring oil from the far corners of a field as large as the one planned.

Blossoming wells

To get all the oil—about 100 million barrels (a barrel is 42 gallons)—drilling experts will drive bits straight down 1000 feet and then angle 58 of them up 70° from the vertical to within 20° of the horizontal and continue drilling for two more miles. When completed, the 58 wells will surround the Cognac platform like the petaled flower of a dandelion. The "flower" will be four miles in diameter.

But before the flower can grow, seeds must first be planted. In this case the seeds are transponders planted by divers in the mud of the gulf bottom after surveyors pinpoint the center of the site and its parameters. Once placed, these beepers will continue their pulsating

signals throughout the life of the construction phase.

So—suddenly—Cognac has a heart. Orienting on the heartbeats, 12 temporary pilings are driven at selected spots around the site. These are the footings for the anchoring buoys that float on the surface and hold barges and derricks in exact locations. This includes the main construction barge that I am on—Derrick Barge No. 16.

But unlike ordinary construction barges, Derrick No. 16 has a brain. Three sophisticated computers receive, monitor, digest and reel off an amazing volume of information.

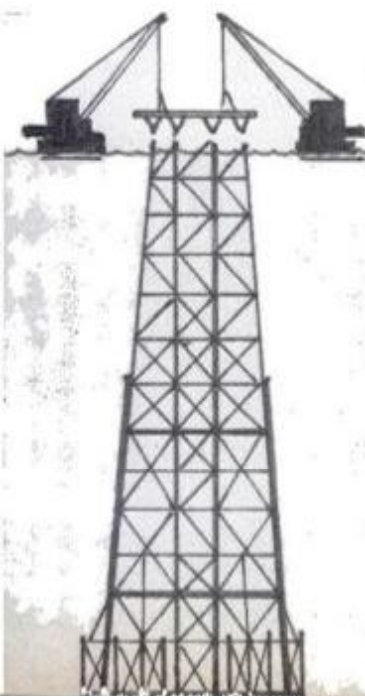
Monitoring devices continually tell the computer how wind, wave and subsurface currents at varying depths are affecting the barge. Comparing this information with the steady beep of a sea-bottom transponder, the computer tells engineers not only if the barge is off station, but exactly how to relocate it.

By now the bottom section has been built and must be barged to the site. Towing a base section over open water that's 1000 feet deep is

(Please turn to page 198)

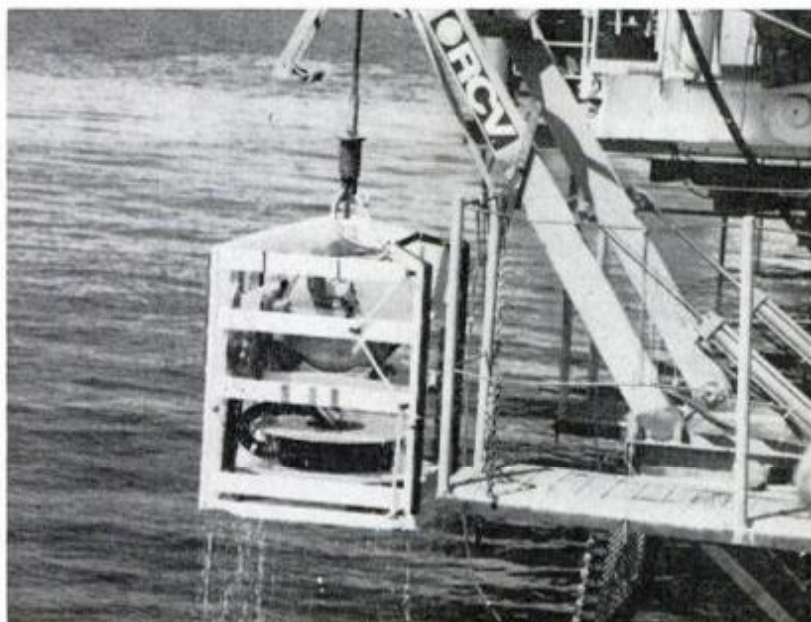


Workman lowers TV camera and lights into center of 7-foot-diameter steel anchor pin. Camera helps locate cowcatcher.



The actual working surface (left) will be 1025 feet off the floor of the Gulf. Two drilling rigs will be erected on this platform.

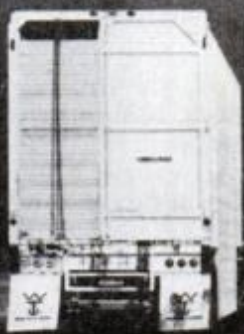
Cage for a remote TV camera and lights (at right) is lowered to divers who work on the rig 900 feet below the surface.



VACATION DRIVING 1978

by E.D. Fales Jr.

What to look for—and look out for—on the road this year



You'll find some changes when you start your vacation trip this summer. That's what we found on a 3300-mile coast-to-coast trip last winter in Chrysler's new Omni/Horizon (See *Cross-country in an Omni* on the opposite page.)

You'd better get braced for new trends—some good, some bad. You'll find: Maps hard to get . . . delays where pavement on bridges is broken up . . . bumpy Interstates where pavement is beginning to deteriorate . . . no windshield wash at many gas stops . . .

You'll also find flagrant disregard of the 55-mph limit on Interstates, where some state police now simply let trucks set the pace.

On the good side you'll find: Self-service gas stations popping up everywhere, often saving 2 to 4 cents a gallon . . . truck stops now catering to tourists, with good meals and even night or weekend repairs available when garages may be closed . . . a new program by the AAA (American Automobile Assn.) to "certify" repair shops and protect you from ripoffs . . . some beautiful new trucks that run silently, smoothly, and can overtake you without the old fuss and fury.

In some ways it will cost you more to drive this year, but competition

seems to be forcing some food and lodging costs down. You'll also find (if you use a camper) that camp areas are often springing up around gas stations—some even with swimming pools.

The disappearance of road maps—and the price we usually had to pay when we could find them—gave us a jolt.

But most shocking was the discovery that you'll have a bumpety-bump ride for hundreds of miles—if you use the right-hand or "granny" lane on some Interstates.

Get maps before you start

We began our trip in San Diego. We had thought to bring some road maps with us, or we would have been out of luck: "Nope. Been out of maps for weeks," gas dealers would tell us. We did manage to buy a Mobil map (10 cents) and a Gulf map (a quarter) but in some stations all we could find (for a price) were maps by Rand McNally, which seems to have moved into the maps-for-pay field in a big way. We tried Getty and Texaco. No maps. And Shell. No maps. Only at Phillips 66 and Exxon stations were we given the old traditional free maps.

Some service station operators were downright angry. "We're sup-

posed to sell those maps for \$1.95," said a dealer near Memphis. "That's too much. We're going to throw the whole darn rack out." Another said that he was actually losing customers.

So get any maps you need *before* you start a trip. If you don't belong to an auto club (we got ours from the AAA Connecticut Motor Club), you might be able to get them free from state tourist booths.

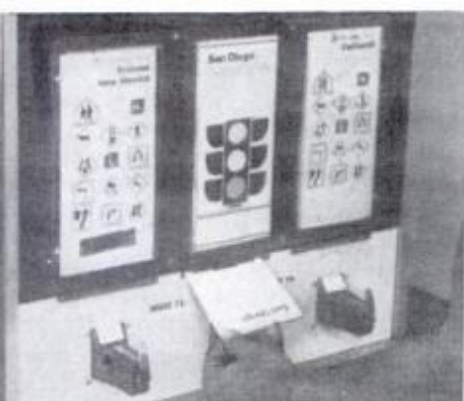
At one service station we got one of the new miniature size maps, so you might want to take a magnifying glass. At a Holiday Inn in New

Don't expect to find service like this often, but it's nice when it happens!





Be prepared for some of these "innovations" during your turnpike travels: Sign above is self-explanatory. As shown below, road maps now will cost you money (some of these machines will take your money and give no map). At right, sign flashes your speed, but where is Smokey? Is he nearby or not? You just don't know.



England we had to put four quarters into a vending machine for a shrunken three-state map. One 10-cent Mobil map was so small you could hardly read it.

Brace for bumps

Some Interstates—even new ones—are pretty bumpy. Reason: Engineers say shippers put such huge loads on trucks, and force drivers to run at such fast speeds, that they're ruining the right-hand lanes. Even the fairly new I-84 in New York State rides like a hobby-horse.

Look out for potholes. Never be-

Cross-country trips are not for the faint of heart; trucks can startle you if you're



fore have we seen actual holes in Interstates—but they're there this year! Even at the 55-mph speed limit, a single pothole can ruin your wheel alignment.

Who goes 55 mph?

Coast-to-coast on Interstates, we saw virtually no enforcement of the national 55-mph speed limit. And I doubt that we saw 20 cars actually going 55 or less.

As for the 18-wheelers: they were never going less than 60 and often, they were hitting 70 to 75. In Texas they were rolling even faster. Driv-

daydreaming. Stay alert and obey keep-to-right-except-when-passing rule.

Trans-U.S.A. in an Omni

A dark shadow suddenly fell over us and we looked back at the license tags of a big compressed-gas tanker, 15 feet behind us with the hammer down. Speak of tight spots! We had considered the new Dodge Omni perfect for parallel parking in tight spots—but not for getting out of the tight spots created by impatient big-rig drivers on the Interstates. Happily, we found that the car does both with ease. It's the compact dimensions of the Omni that do the trick when parking, of course, and the small but powerful Four that provides the zip.

We picked up the Omni in San Diego last December. It had been yanked off the assembly line at Belvidere, Ill., only days before and shipped to San Diego for its West Coast preview.

The drive from San Diego to New York would be an excellent way to experience, first hand, how cross-country travel had changed since our last coast-to-coast several years ago.

Friends said, "Aren't you worried?



Omni trunk so swallows luggage that we never had to use the roof rack.

How do you handle such a little car in the wolfpacks on expressways?" And they warned us about the bugs that crop up in the first 1000 miles of driving a new car.

We had never driven so far in a small car so we brought a spare cushion for the driver's seat, expecting to be jolted to pieces. We worried that we'd reach New York scared—if we got there at all—and half dead from exhaustion.

As it turned out, it was one of the most enjoyable "crossings" we've had. We were pulled across the country by the Omni's front-wheel drive, almost without steering. In bigger cars, we used to count how many times you have to move the steering wheel from 2 to 4 inches in order to stay on a one-mile straightaway. It averaged 100 to 125 flicks (some slight, some larger) per mile. This means that in 10 straight miles you flick the wheel 1000 times or more. That adds up to work.

But with the Omni we were averaging only 16 wheel adjustments per mile.

(Please turn to page 94)

TRANS-U.S.A. IN AN OMNI (Continued from page 93)

And most were mere fingertip adjustments *often one-half inch or less.*

So in 3300 miles we save close to 250,000 steering movements! The car almost steered itself across America. With such a saving in muscle energy, no wonder we never once felt tired.

How much gas?

EPA says Omni/Horizon goes 39 mpg in open country and 26 in town. Forget EPA: The real-world figures we've found



Omni's fwd literally pulled us 3300 miles cross-country last December and . . .

are far different. With its tight new engine, Omni ticked off the first 1500 at 28.6 to 31.6, which was remarkable because we had five luggage bags, a heavy suit carrier and airconditioning part of the time.

Toward the East, again in mountains, it was clipping off 32.5 and 33.5 averages for a day at a time. Average, San Diego to Allentown, Pa., 3013 miles: 30.6 mpg.

But next (photo, at right) there came 175 miles of ice so vicious it halted traffic for two hours on a mountaintop for miles. Then came 150 miles through rough New England into New York City bedlam. Average for this last mixed stretch: 27.9. So for 3300 miles, figure close to 30 mpg.

Space and visibility

Despite our big luggage loads we never had to use the roof rack. Nor did we even turn the rear seat down to open up the big rear cargo space. Legroom both front and rear is good.

With the big hatchback window you see better than in most cars *all* the road traffic behind you. Also, when trucks overtake, you feel less buffeting: that's due to the fwd.

What about airconditioning?

Omni offers it for \$472 extra. It was great in Texas. But here's a suggestion for Chrysler: Eliminate the thermostat controls. Twice a minute our airconditioning would cut in and we'd feel a slight drop in speed. Nine seconds later on the dot, the conditioner would cut out and the car would surge ahead. Full-time airconditioning with manual settings would end all this.

Needed options

A rear window-washer (\$59 in Omni) is an absolute necessity, especially in snow or ice.

Our Omni had a proper day-night mirror and we think it should be a standard safety feature, not optional. Omni's base price is \$3706 but when you add the day/night mirror to all the other options, our deluxe Omni checked out at \$5700.

Other things we liked . . .

- The smart looks.
- Omni's plastic-lined fenders for salt and rust protection.
- Omni's handy console-tray—for toll coins, etc.
- The drop-back seats. I slept several times in them in full bedlike comfort.
- The easy-to-enter doors, and the roominess inside.
- Ability to thread through traffic and other obstacles where bigger cars can't go.
- Nice workmanship.
- The easy way you can sponge-wash the car in mere minutes.

Only two problems

We didn't get across the country scot free. First, we had trouble with a hose on the power-steering system. When it came loose we lost power-steering fluid; consequently, a greater effort was needed to steer the car until we rolled



. . . despite weather like this ice storm in Pennsylvania, it was an easy trip.

into a Dodge dealer for repair and check-out of the system.

The second problem was more annoying. The passenger-side foot well became a *well*, indeed. A water leak in the cowl area was the culprit. The thick carpeting in the Omni was a very effective sponge but no solace. We didn't bother to have a dealer find and plug the leak and returned the Omni to Dodge in New York with still-damp carpeting.

Summing up

A funny thing happens to a driver in a car like an Omni. Through your windshield all bigger cars start to look out-of-date! Soon they actually will be. In terms of driving fun, big-car drivers don't know what they're missing. It's a whole new world of driving.—E.D.F.

ers told us: "We drive behind the trucks. Since they don't arrest them, we figure they can't get us."

Mebbe so. We soon concluded that in some states police simply don't try. They let trucks roll.

Take exact change

You may have trouble getting gas this summer if you don't have the exact change. Tired of being robbed, more and more dealers are simply refusing to make change, especially after dark.

So you must have dollars, and the right combination of nickels and pennies, to drop in an iron safe. Or else you must carry credit cards "approved by this station."

It will cost you more

Driving costs are up this year. AAA figures 20.2 cents per mile for an intermediate car; up from 18.3 cents in two years. Add for a bigger car; subtract for a smaller.

Should you use your air conditioning? Says AAA: it costs 20 cents per 100 miles—not bad for the extra comfort (and, therefore, *safety*).

But be careful of two new problems. Twice, we were overcharged for gas (once at a whopping 95 cents a gallon at a big-name-gas-company station in Virginia which had advertised unleaded gas at 68.9 cents. (We found the overcharge later, since we keep our credit card receipts.)

The other possible problem could be keeping leaded gas out of your tank if your car requires unleaded. Dealers told us some stations (allegedly by local request!) now pump *leaded* gas through the mini-nozzles. That's because leaded gas is cheaper. This is a \$10,000 federal offense for the service station. But for you it's a ruined catalytic converter.

Breakfasts for 99 cents

We expected food prices to be sky-high. They weren't. We did pay \$2.50 for some breakfasts. Then we began to see Stuckey signs: "99-cent breakfast—orange juice, eggs, toast, coffee." We tried them. Delicious food. Immaculate surroundings.

Free movies . . . kids free

You can also save on amusement costs at some motels that now offer first-run movies (uncut) in your room, free. Some also make no overnight charge for kids. And if there's a senior citizen in your group, be sure to ask for the 10-percent discount some motels give.

Off-beat amusements

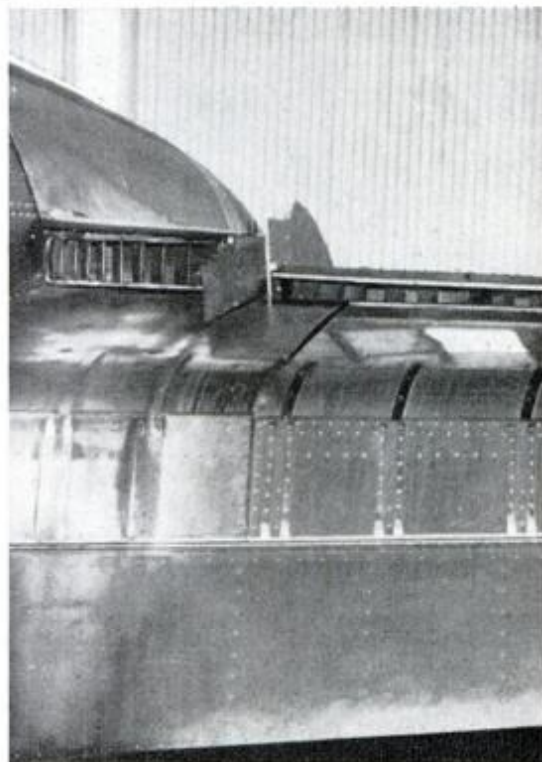
Balloon rides, "white-water" boat rides on some rivers, and aerial

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IT'S NEW NOW

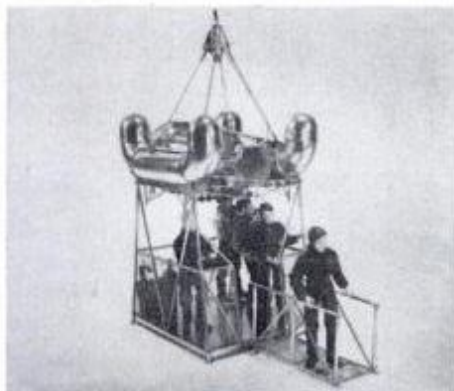
Double wings help jet operate like STOL aircraft

No, you're not seeing double. The winglets above the main wings on this Ball-Bartoe Jet Wing plane help to control airflow as part of a new experimental "propulsive-lift" wing. Exhaust from the jet engine is ducted over the wings for increased lift, which is useful during short takeoff and landing (STOL) and low-speed maneuvers. The Jet Wing has been flown as slow as 52 mph and still maintains positive handling. Ducts over the wings are visible in photo at right (winglet has been removed). Engine exhaust exits through ducts in fuselage; air from engine bypass fan exits farther out over wing. The winglets also add stability in normal flight.



Flying fire engine

Tied to a helicopter, McDonnell Douglas' ducted-fan-powered platform (model shown) is designed for rescues from skyscrapers, other inaccessible areas.



Beetle mania

Deathwatch beetles were destroying rare volumes at Yale's Beinecke Library. Now 37,000 books there are being frozen for three days at minus 20° F. to kill bugs.

His bite is worse than his bark

Now that you've finished paying off your child's orthodontist, you can make an appointment for your dog. At right a Louisiana dentist takes an impression of Fido's canines to fit him for braces that will improve his bite.



Scooter belongs in jet age

It can be tough to get around in today's sprawling airports. At Copenhagen's Kastrup terminal, the old-fashioned scooter modernized with smooth handbrakes moves employees on long runs.



30-mile 'donut' to spin out atomic secrets

World's mightiest atomic accelerator, so huge it will span the border between two European countries, may unlock deep mysteries of the universe—and unleash virtually unlimited supplies of vital electric power.

by Hans Fantel

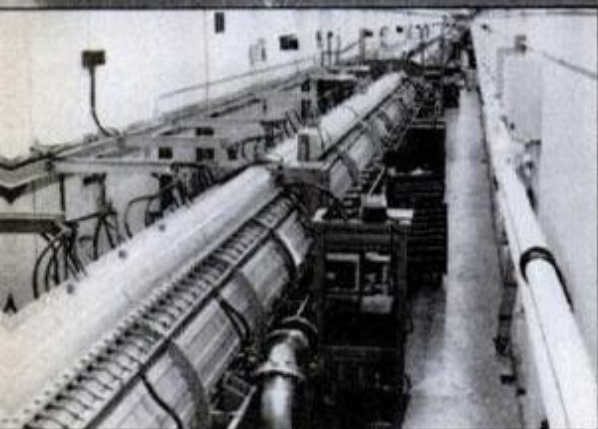
It will be so big you can see it in its entirety only by looking down from a mountaintop or airplane. A circular tube with a mind-boggling circumference of 30 miles, it's the largest machine ever conceived. It's still in the planning stage, but represents the most ambitious concept yet for building an atomic particle accelerator—popularly known as an atom smasher.

Why the incredible size? Such devices need a long path to accelerate their subatomic particle "bullets" up to the tremendous velocities required to penetrate and break down matter at the atomic level—just as a jumbo jet needs a long runway to get up to flying speed. The longer the path, the greater the acceleration that can be achieved.

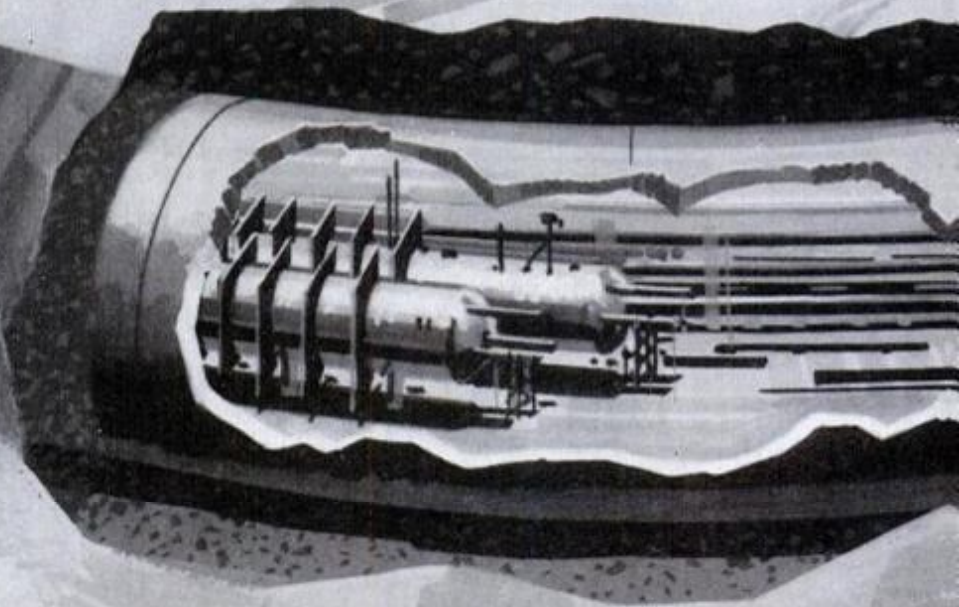
Is such a giant merely a paper

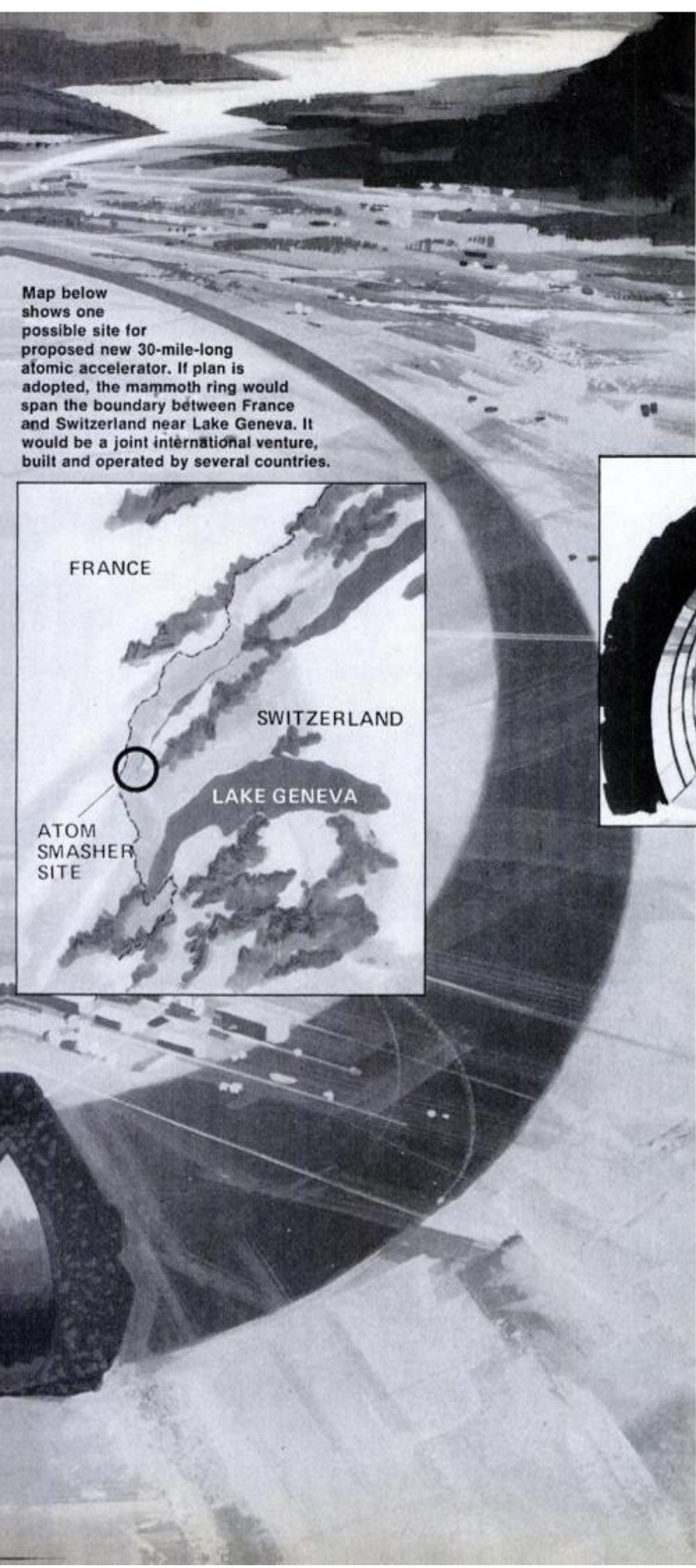
dream? By no means. The technology for building it exists—the final design, financing, location of construction site, and certain political considerations must still be worked out. But atom smashers have been getting bigger and more powerful all the time—a sign of even more ambitious projects to come. The famed Brookhaven accelerator, half a mile in circumference, is already dwarfed by a similar one with a four-mile girth at Fermilab in Batavia, Ill., currently the biggest atom smasher in the world. And now being planned is another, more modern installation for Brookhaven that will outpower them all—at least until that 30-mile monster goes into operation.

The newly proposed superaccelerator still has no official name. It's just

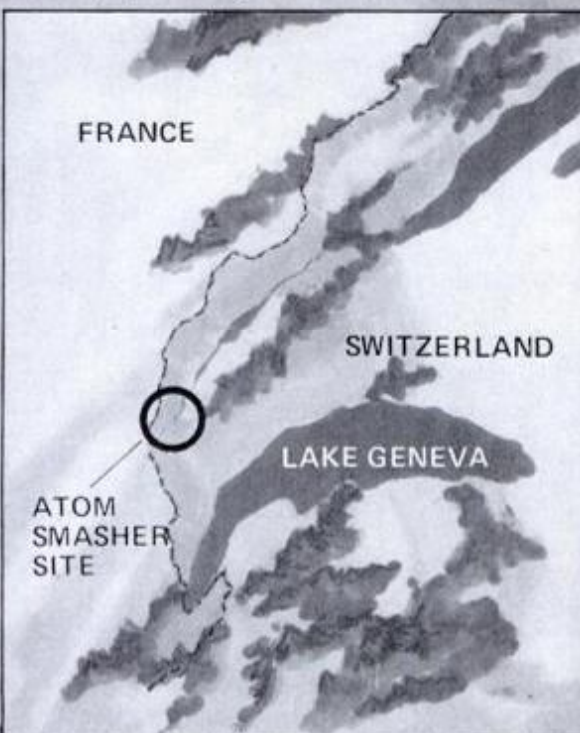


Like an entry ramp to a superhighway, this 500-foot-long linear (straight-line) accelerator at Fermilab pushes protons up to velocities needed to enter high-speed lanes in main circular accelerator. Such "preboosters" will be used in proposed 30-mile atom smasher shown above.





Map below shows one possible site for proposed new 30-mile-long atomic accelerator. If plan is adopted, the mammoth ring would span the boundary between France and Switzerland near Lake Geneva. It would be a joint international venture, built and operated by several countries.



called the VBA—short for Very Big Accelerator, which is an understatement if there ever was one. While the primary objective of the VBA will be to explore the properties of the atom and physical laws governing the universe, its findings may also lead to new ways of mass-producing nuclear energy in safe, economical, commercially usable quantities. If so, such discoveries might well provide virtually unlimited supplies of urgently needed electric power.

Since the VBA will be such a gigantic and costly undertaking, it is unlikely that any one nation could afford to foot the bill by itself. Thus



Plan for new Brookhaven accelerator has two tubes whirling counterrotating proton beams. Future 30-mile atom smasher depicted at left may use same arrangement.

the United States, the Soviet Union and several European countries are expected to chip in, making the project a truly international effort.

While a site has not been definitely chosen, the VBA will probably be built near Geneva, Switzerland (see map at left). To accommodate its immense size—and also to symbolize its international character—it may lie partially in France, straddling the French-Swiss border.

Actually, you won't be able to see the VBA as a whole at all since most of it will be constructed underground, with above-ground service and laboratory facilities stationed along its length. If all goes according to plan, the giant machine will be switched on in the year 2000—a fitting technological milestone to mark the turn of the century.

New twists in technology

All atomic accelerators are basically similar in principle and share the same purpose: to produce an intense beam of subatomic particles, such as protons, that will penetrate

and fracture the most mysterious concentration of matter—the nucleus of the atom. Within this infinitesimal body, scientists hope to find the answer to the long-sought fundamental question: What is matter?

The proposed VBA will be essentially the same as existing accelerators but on a much more massive—and therefore powerful—scale. It may also employ exciting new particle-beam techniques just recently developed. The new installation planned for Brookhaven, for instance, is already pioneering radically advanced accelerator technology. Nicknamed Isabelle, it will use not one, but two proton beams, whirling around in *opposite* directions. Each ring will be surrounded by more than 500 superconducting

of elusive *quarks*, believed to be the ultimate units of the universe. Another reason is that it may reveal the link between nuclear forces, electromagnetism and gravitation. This relationship was vainly sought by Einstein as an extension of his general theory of relativity. Physicists now believe new clues can be gained from particles called “immediate vector bosons” whose mass is so great—100 times that of a proton—that present accelerators can’t push them fast enough to produce useful results. Scientists hope the VBA could.

Other areas of research in which the VBA could prove invaluable lie in the study of superconducting magnets for more efficient power transmission, the generation of new

mile-long circular accelerator to ever-increasing velocities.

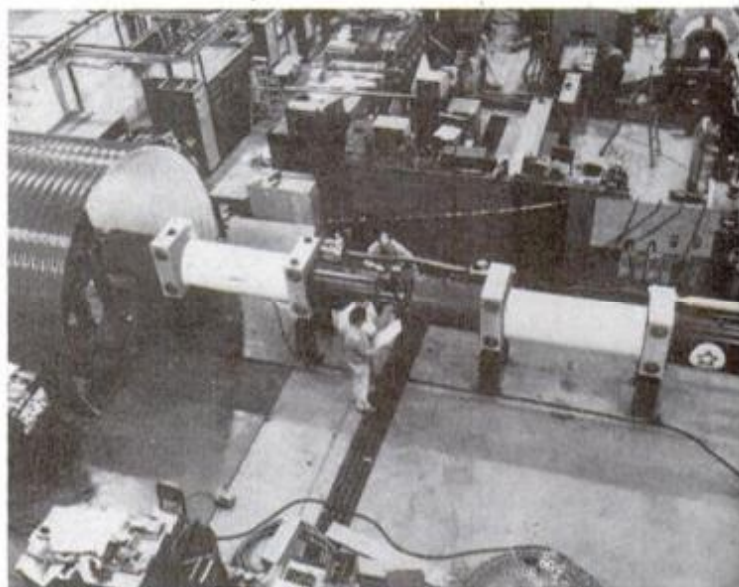
The “stilts” are huge ceramic insulators rising 40 feet from the floor—for good reason. The entire generator is charged at 750,000 volts to knock out protons from atoms of superheated hydrogen. Thanks to those massive insulating columns, technicians can work inside the generator without being electrocuted by this enormous voltage—like sparrows sitting on a high-tension wire.

Atomic nucleus a tiny speck

As we picked our way carefully along lofty catwalks, my guide explained the basics of modern nuclear physics. In the past, scientists studied reactions between *whole* atoms. Today, the objective is to get



Art concept shows 3/4-mile-diameter ring planned for Brookhaven's Isabelle accelerator. Ring will contain counterrotating proton beams that collide in “big bang” to produce huge force.



Pilot model of Brookhaven's Isabelle shows one of two accelerator tubes already in place. Corrugated metal “sewer pipe” simulates big underground tunnel that will house the twin tubes.

magnets and be capable of accelerating protons to an energy level of 400 billion electron-volts (abbreviated 400 GeV).

Now comes the neat trick. Periodically, the two counterrotating proton beams will be made to collide head-on. The resulting “big bang” will double the energy level to a colossal 800 billion electron-volts, or 800 GeV. By comparison, the present Brookhaven accelerator develops energy levels of 33 GeV, while its larger cousin at Fermilab in Illinois has been revved up to 500 GeV—impressive but still below Isabelle's projected output. What the enormous 30-mile VBA could produce staggers the imagination.

The quirks of ‘quarks’

One reason why the International Union of Pure and Applied Physics is pushing for the VBA is the hope that it will put them on the track

forms of nuclear energy, and the use of nuclear radiation in possible lifesaving medical applications.

To get a better idea of how the VBA may be expected to work, I made a personal visit to the current accelerator at Brookhaven National Laboratory in eastern Long Island, N.Y. This one, called the Alternating Gradient Synchrotron (AGS), serves as a kind of working model for the more powerful Isabelle and even greater machines of the future.

The AGS was taking the week off for overhaul when I arrived, which gave me a chance to walk right into its very innards. Clambering up to the particle source, I felt like a monkey on a skyscraper scaffold. Looking like a house trailer perched on stilts, this towering chamber is the generator that spews out protons—positively charged particles—that are then concentrated into a tightly focused beam and whirled around the half-

inside the nucleus of a *single* atom and explore the baffling secrets of its intricate structure. This isn't easy. To get an idea of the size of an atomic nucleus, imagine a large auditorium as representing just one atom with its spinning array of orbiting electrons. In this case, the nucleus would be a tiny speck at the center of the hall.

How do you find and penetrate something so small? It takes tremendous power, incredibly complex equipment—and a large measure of luck. In fact, luck, though seemingly not a very scientific tool, is exactly what nuclear physicists are hoping for most. Bombarding the nucleus of an atom with a stream of protons is like a hunter spraying shot at a fleeting bird on the random chance that a few of the pellets may find their mark. Most don't.

To hit an atomic nucleus and get
(Please turn to page 222)

IT'S NEW NOW



No snow? Let's go roller skiing

A lack of snow doesn't stop cross-country skiers in Norway. They get out their roller skis and head for a paved road. Each ski has a single front wheel that spins forward only—a clutch keeps it from rotating in reverse—allowing for the use of normal skiing techniques. Two smaller wheels at the rear are braked when a skier presses the back of his legs against a metal frame (photo below). Skisu roller skis, with a suggested retail price of \$180, are distributed by Nortur, Inc., Minneapolis, Minn. 55441.



Just blow the debris away

A quick way to clean gutters—if your roof isn't too steep—is with Echo's PB-202 backpack blower. It's powered by a 2-cycle engine, weighs less than 12 pounds and sells for under \$200.



Phone calls the easy way

Push a button and the Keymemo dialer calls one of 15 preset numbers. Unit can be used with all types of phones, sells for \$220. Chung Long Electronics, Box 18732, Seattle, Wash. 98118.



Two lights in one

The flick of a switch changes Q-Beam's Spot/Flood from a powerful spotlight to a wide-arc'd flood. It retails for \$34.95, operates from any 12-volt power source.

No waste motion

Trash in Phoenix gets the deluxe treatment when a new one-man garbage truck pulls up. Operated from the cab by the driver, an arm swings out and picks up a special polyethylene container. After emptying it, the arm replaces the container. The service is gradually being extended throughout Phoenix; it's hoped the city will be covered by 1980.



Vicious-looking, four-barrel Soviet Quad ZPU-4 at right is a highly mobile, versatile attack unit that can be used against both aircraft and ground targets. It has an effective antiaircraft range of up to 7000 meters—almost 23,000 feet—and a rate of fire of 500 to 600 rounds per minute. Learning how to cope with it will be the job of our Army's special OPFOR "enemy attack" force. Below, tanks and armored personnel carriers used by OPFOR units strike in massive drive to test effectiveness of our battle defenses.



You're taking the family out for a Sunday drive and decide to visit a nearby military base, one that's partially open to the public such as Fort Carson in Colorado. There's a fascinating war museum to browse around in, and you can stop by the airfield for a peek at huge tank-busting choppers.

As you top a rise in the road, you're suddenly confronted by soldiers wearing—unbelievably—Soviet-type uniforms. They speak in Slavic and brandish vicious Russian-made automatic AK-47 assault rifles. Even more unbelievably, you glimpse in the distance what appears to be a Soviet battle tank of a type you've seen in pictures.

Fantasy? No. The tank is real—an actual Soviet T-62, mainstay of Russian mechanized might and one of the deadliest, most heavily armored battlewagons in existence. You've stumbled onto a roadblock set up by an OPFOR company of the U.S. Army's 4th Infantry Div. (Mechanized). While the tank is genuinely Russian, the men who man it are American. They are not, however, just "dressed up" to look like Russians. They are a completely separate force from our regular army, taught enough Slavic to sound foreign, equipped with real Russian weapons and intensively trained in the use of Russian tactics.

OPFOR stands for Opposing Force. Its job is to play the part of an enemy force—any enemy—that might threaten our national secur-

How we play our war games with Soviet pieces

Don't be surprised if you see a Soviet T-62 main battle tank rumbling toward you over a hillside. It's Russian, all right, but don't panic—the Russians aren't coming. It's our latest way of testing opponents' weapons to see how good they—and we—really are.

by Jack Galub



Awesome Soviet BMP is armored personnel carrier and potent attack vehicle, carries 73-mm cannon, guided missiles, crew of 11. Men inside fire through ports.

Материал, защищенный авторским правом

ity. Pitted against our regular forces in mock battles, OPFOR units perform two important functions: They give us a chance to test the effectiveness of foreign weapons and they evaluate the efficiency and resourcefulness of our own forces in fighting against unfamiliar equipment.

For the most part, Soviet weapons are employed—not because we consider Russia the inevitable enemy—but because they represent the kind of arms most likely to be used against us by an unfriendly nation. In addition to those at Fort Carson, OPFOR units are now operating at Fort Hood in Texas and at many other military bases around the country. Eventually, OPFOR units will be permanently attached to every U.S. infantry division.

Behind these war games lie some grim statistics. While exact figures are classified, it is no secret that Soviet-supplied Warsaw Pact nations enjoy a military superiority—at least in ground forces—of about

three to one over NATO forces, of which the United States is a member. One authoritative estimate puts Warsaw Pact forces at 141½ divisions against 45½ NATO divisions. Warsaw Pact armies would be supported by 27,000 tanks and 8000 to 9000 artillery pieces, compared to the West's 10,000 to 11,000 tanks and 6000 artillery pieces—not very attractive odds.

What's more, Soviet equipment has proved to be impressively good. A high-ranking Army spokesman recently told the Senate Appropriations Committee: "We tend to think of armor expertise as a German forte, but often forget that the vast majority of German tanks that fought in Russia were greatly outclassed by the T-34 (Russian tank), easily the outstanding ground weapon of World War II."

There is little doubt that an aggressor force could mount a swift and sudden assault on NATO positions if it wished. Russian bombers



Soviet-garbed "enemy" soldier takes aim with Russian-made RPG-7 antitank missile launcher resembling our old bazooka. Photo is staged; in actual firing tests, men would not stand on or near tank.



One of mightiest tanks today, Soviet T-62 (left and below) is formidable weapon, yet was outclassed by American-made M-60s in 1967 Arab-Israeli war. Here, a T-62, captured by the Israelis and turned over to us, is used in simulated combat maneuvers to provide realistic training for American soldiers.

accompanied by MiG-23 fighters regularly fly simulated attack sorties into western Europe, turning back just short of penetrating Swiss air space. Someday, they might not turn back. At the same time, heavily armored Soviet ground units, poised along the Czech and Hungarian borders, could quickly strike westward.

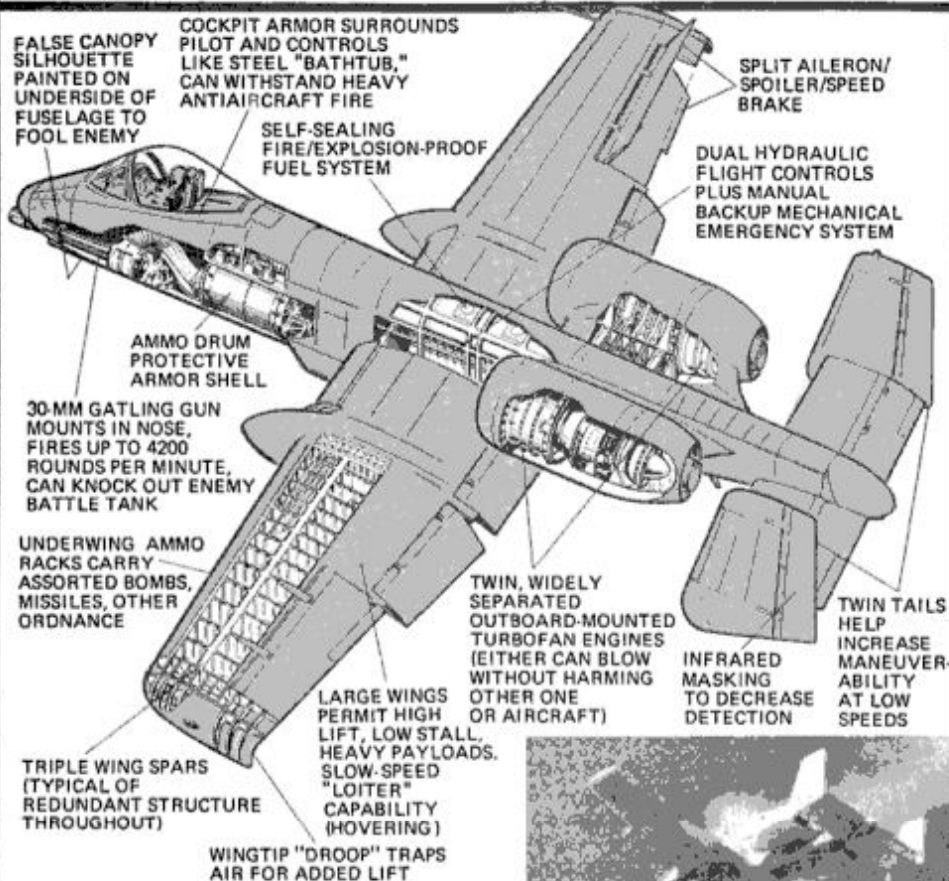
Not much time to get ready

While such an attack could never come as a total surprise, the big question is just how much advance warning we would have through intelligence and surveillance. At present guesses range from

Low-slung silhouette of Soviet T-62 battle tank makes it hard to hit, but it lacks the sophisticated controls and maneuverability of our tanks.



The 'ugly duckling' that is ugly only to our enemies



It swoops in low over the treetops, undetected by enemy radar. Suddenly the pilot pulls up in a steep 5-G climb. It looks like the start of a loop, but just as he's in a vertical climb, the pilot half-rolls the plane and puts it into a screaming inverted dive. Below is a Soviet T-62 main battle tank. As the pilot nears the ground, he quickly rolls upright again, plants the cross hairs of his gunsight on his unsuspecting quarry and squeezes his stick trigger. One-pound explosive projectiles spew out from a 30-mm nose-mounted gatling gun at the awesome firing rate of 4200 rounds per minute—70 a second. The tank erupts into a fiery mass.

The operation is a practice exercise, but the combat conditions are authentically staged. The T-62 tank is a real Soviet make, obtained through secret sources for test purposes (see text). The plane is the Fairchild A-10, our Air Force's newest and deadliest weapon for close-in air support of ground troops. It's a strange aircraft—relatively slow, oddly built, a bit dumpy-looking. It may never win any beauty contests, but to battle-weary infantrymen facing heavy enemy armor it's a lovely sight.

The A-10 is designed to do just one job—fight the enemy on the ground. Its big, fat wings give it high lift, heavy payload capacity and STOL capability for operating out of short, hastily prepared front-line airstrips. While it can carry any mix of bombs, rockets and other ordnance in its underwing racks, that vicious armor-piercing nose cannon is probably its single most devastating

weapon for low-level strafing. The plane is what is known as a "high-survivability" aircraft. It must fly into hornets' nests of enemy ground fire and come out—if not unscathed—at least intact.

The ultimate in fail-safe engineering, the A-10 has twin engines mounted outboard of the fuselage on stand-off pylons, one on each side. If one explodes, it does not endanger the other engine or the aircraft itself. The engines are turbofans—much quieter than pure jets—to make them harder for the enemy to hear. Self-sealing fuel tanks are fire- and explosionproof. Pilot, instruments and controls all sit in what amounts to a heavily armored, bulletproof "bathtub" designed to stop the powerful 23-mm antiaircraft shells used by Soviet-armed Warsaw Pact nations. Control systems have hydraulic and manual backups; some have backup backups.

Because the A-10 must come in low, it cannot "peel off" and dive like high-flying fighters and bombers. The quick-climb, flip-roll, inverted-dive maneuver gives it the needed speed and high attack angle for a surprise assault. A clever touch is a false canopy silhouette painted on the underside to confuse the enemy—the plane can appear upside down when it's really right side up, making it hard to tell just when and where it's about to strike.

—Shel Gallagher

15 days down to as little as two—not much time to get ready. Thus the reason for such special training aids as OPFOR.

Literally hundreds of carefully staged scenarios, representing different battle situations and strategies, are realistically played out, then intensively analyzed. Often our regular army units do not know when, where or how the "enemy" OPFOR forces will strike. They must be constantly alert.

Often, too, live ammunition is used, though not, of course, in a way that would endanger personnel. We shoot at unmanned enemy armor using our weapons, then shoot at our own armor using enemy weapons, to see how well each stands up.

In a typical mock battle, OPFOR tanks attack in a double column until forced to deploy. Then they spread out, forming a "sea of tanks" with lead battlewagons about 55 yards apart. These are followed by armored troop carriers, then come tank-killer BROM vehicles carrying SAGGER missiles. The force smashes at isolated or small dug-in units, requiring immediate command decisions.

How we get 'enemy' armor

Where do we get this "enemy" armor from? Not, obviously, from the Soviets directly, though soldiers only half-jokingly talk about "placing orders" for what they want—and getting it. Some comes from highly secret, indirect sources through complex international dealings. Much, however, is known to be captured equipment taken by the Israelis from Soviet-armed Arabs and turned over to us.

Our troops have learned that, while good, Soviet weaponry is not necessarily better than ours. It is, however, different in many respects and requires special defensive tactics and countermeasures. Soviet tanks, for example, are noted for their low, hard-to-hit profiles. But they pay a price in lack of comfort and maneuverability. Driving a T-62 means wrestling with a manual gearshift and two steering levers, like those on old-fashioned farm tractors.

"The T-62 is tiring to drive," says a Fort Carson OPFOR operations officer. "By the time we get one on the road, our drivers are suffering with headaches."

Our tanks' power steering and automatic transmissions give them greater agility and faster reaction time. Their superior gunsights and turret action, and the longer-range accuracy of our 105-mm guns, can take a heavy toll on enemy armor. This was dramatically proved from first-hand experience when Israelis



Simulated Soviet SAM missile site is impossible to tell from the real thing. Unwary bombers caught in its radar net will be electronically "killed." At left, an F-4, playing the role of a Russian MiG, rides the tail of an F-16 in mock combat.

using American M-60 tanks consistently outfought Soviet-supplied Arab T-62s in the six-day war of 1967.

Newer, more potent tanks

The Soviets are keeping their newest T-72 tanks carefully under wraps, but we know enough about them to be able to assess our own new XM-1's potential against these latest Russian behemoths. At high speed on rugged terrain that would destroy the suspension on most modern tanks, the XM-1 has already proved it can hit a five-foot target a mile away while bouncing over an obstacle course.

While the race is on to build tougher, more formidable tanks, we are also striving to develop more lethal tank-killers. OPFOR instructors have respect for the Soviet RPG-7, a one-man, shoulder-fired, rocket-propelled antitank missile launcher similar in appearance to our old bazooka, though much more devastating. Its shell can penetrate 7 feet of sandbags before exploding and can easily punch through the heaviest armor. Our equivalent is the LAW antitank missile launcher, now being supplemented by the even deadlier DRAGON. The DRAGON missile launcher, distributed to special weapons squads, is more potent and easier to handle than either the Soviet RPG-7 or our own LAW.

Ultimately, however, the greatest threat to tanks probably comes from the air. The Soviets are fielding the HIND, the world's most heavily armed attack helicopter. It carries an awesome assortment of antitank guided missiles, free-flight rockets, bombs, cannon and machine guns.

Our main attack chopper is the Cobra, armed with guided TOW missiles said to be vastly superior to the Soviet SAGGER. The TOW is 97-percent accurate up to 3000 meters (about 3250 yards). Even more fear-

some as a specialized tank-killer is the AAH, a smaller copter equipped with laser-guided HELFIRE missiles. AAH is designed to hover behind hills, zoom up vertically, blast away at attacking tanks, then drop back down behind cover again.

The Air Force has come up with what may be the ugliest as well as deadliest close-in ground-support fighter, the Fairchild A-10 (see *The "Ugly Duckling" That Is Ugly Only to Our Enemies*, page 102). This two-engined, oddly shaped monster is fitted with an armor-piercing gatling gun and assorted missiles designed to do one job—smash enemy armor. Its cannon alone can turn the T-62 into a sieve.

Operation Red Flag

The Army isn't the only military service using foreign weapons and tactics to train its fighting men. The Air Force has its Operation Red Flag, which is to airmen what OPFOR is to soldiers—a simulated but realistic "enemy" to fight against.

While no one will say officially, it is rumored that the Air Force has its own secret squadron of actual Soviet MiG fighters, with as many as 25. Whether they exist or not, the idea behind Red Flag is to pit U.S. fledgling fliers against seasoned American pilots who use Soviet fighter tactics while flying, if not real MiGs, F-5s and F-5Es painted to resemble MiGs. The "enemy" pilots are not only superior fliers, but many are combat-experienced from Vietnam.

As in the OPFOR program, planned scenarios are realistically staged to represent a variety of typical combat situations. "Red" teams are the bad guys, "Blue" teams the good guys. Fighter and bomber units fly exactly the same missions they would in wartime.

Behind Red Flag lies a vital life-

or-death statistic. From experience, the Air Force has learned that the first 10 combat missions are the most dangerous for any raw pilot. If he lives through the magic 10, the odds for survival shift dramatically in his favor. That's the purpose of Red Flag—to give our pilots and crew men the realism of battle experience that will help to save their lives should an actual war come.

In mock dogfights, Reds and Blues mix it up fiercely, with gun cameras and video tape recorders blazing away to score "hits" or reveal errors resulting in misses. Any pilot not constantly on his guard is "shot down." A squadron of Blues swooping down on a column of tanks in what appears to be a routine bombing run is suddenly pounced upon by enemy Reds diving out of the sun or roaring in low over hilltops. The Blues must learn to ward off the attackers while still accomplishing their bombing mission.

How good are we?

The results of such programs as OPFOR and Red Flag are highly encouraging. One fundamental difference in tactics that regularly shows up is the greater flexibility allowed Western forces compared to the more rigid, chain-of-command doctrine drilled into the Soviets. From field commanders to squad leaders to individual tanker crews, our men are taught to think and act on their own when conditions demand it. This should give us an edge in battlefield situations calling for critical, split-second decisions. And our weapons are as good as, or better than, most comparable foreign arms.

You may never see a Soviet T-62 tank rumbling down the road at you or a MiG-23 screaming out of the skies, but it's comforting to know that we can deal with them—if the need should ever arise—because we've "fought" them right here. **FM**

10 new shortcuts

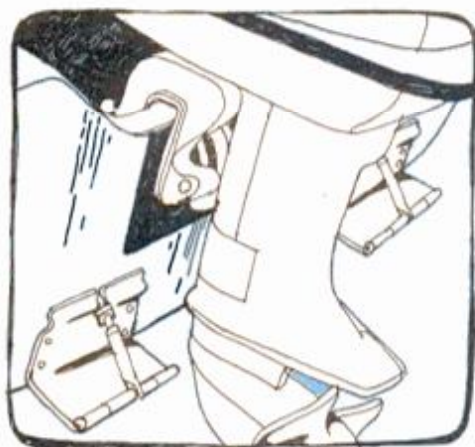
Improvements added make boating better all season.

by Bill McKeown

BOATING EDITOR

Although going afloat is now almost a year-round sport, spring is still the ideal time to check or recheck your rig. This year, while checking yours, remember there are now more ways than ever to update for more action.

For example, there's no longer an excuse for a planing hull to plow or



porpoise if power and prop are correct. Experiment with trim tabs and afterplanes for quicker lift, level ride and fuel economy. Fixed, spring-loaded and adjustable tabs are available, and some can be adjusted from the driver's seat.

Your well-equipped marine supply store should also stock new electronic aids that are easier to add at fitting-out time.

A tachometer for an outboard (or your inboard engine, if it doesn't already have one) simplifies finding the optimum speed for fuel economy. Through-bolting the transducer for a new depth-and-fish finder is also best done before first launching.

Consider wiring in a water-temperature gauge—and even new oxygen percentage and water acidity meters if you're an ardent fisherman.

Rig antennas for CB and VHF transceivers if you plan to operate

away from shore. New antenna designs can increase your transmitting signal strength, and mounting them as high as possible will increase their range.

Even the smallest boat can stow a walkie-talkie CB, plus one of the new pocket-sized transistor radios that receive both AM and VHF nonstop weather channels.

If your powerplant was running well before cold-weather haul-out, it probably doesn't need a complete overhaul before your launching, but it will benefit from spring maintenance. Auto engines wear out from use, but pleasure craft mills can disintegrate because they've been sitting unused for long periods in a damp and corrosive atmosphere.

Check the ignition; it's the major cause of problems. Outboard plugs now have much longer life, thanks to high-voltage CD systems, but buying a new set still is a cheap way to prevent trouble. A quick examination of all wiring, a dose of antimoisture spray, and replacement of any suspicious looking wires are also worth your while.

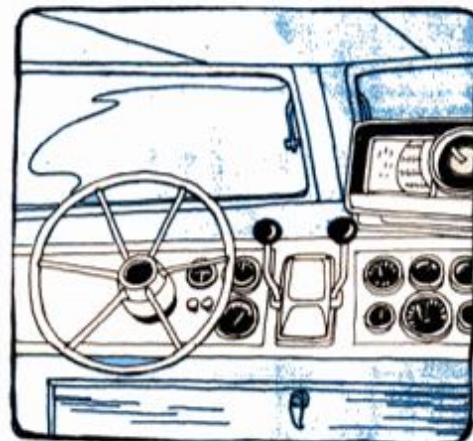
When your boat was hauled out for the winter, the fuel tanks should have been filled to the top to help prevent water condensation, or emptied to prevent fire hazard.

In either case, you should check the tanks for sediment; flush them if possible, and treat gasoline or diesel fuel with a gasoline additive. One pint of methanol or isopropyl alcohol in 50 gallons of fuel will do the trick. Check and clean all fuel filters, and if you don't have any, consider installing some. They will prevent tank sediment and water condensation from reaching your carburetor.

If you're lucky, your powerboat has an instrument panel with an engine-temperature gauge, a tachometer, gas gauge and speedometer. A trim-angle indicator for your outboard or sterndrive and an oil-pressure gauge for your inboard are better still. If you lack any of these, now's the time to add them. You should consider an engine-hour meter, bilge sniffer and

warning lights for engine temperature and bilge water level, plus a battery charge-level indicator.

Consider as well the installation of



a spark-and-explosion-proof ignition safety switch that turns on a bilge blower for several minutes and vents gasoline fumes overboard before the engine starts. Warning horns can be wired to overheat, bilge-water and gas-accumulation sensors. An instrument-panel digital depth finder repeater is also useful; it can be set to sound an alarm before the water becomes too shallow under your keel, or indicate a dragging anchor during the night.

5

Work a deal with your dealer, if you can, to rent or borrow several propellers of slightly different diameter and pitch. Trial and error is still one of the surest methods to fine-tune the performance of any particular boat. Every hull will move through the water with varying degrees of efficiency at different loaded weights, and the only way to optimize performance with fuel economy is to work with your engine manual, a tachometer, speedometer or stopwatch and, ideally, a fuel-flow meter.

Both outboard and inboard engine instructions specify peak rpm. Swap props until you reach the peak at full throttle, along with the best speed over a measured course or on your speedometer.

Don't experiment with a high-speed cleaver or surfacing prop, however, if you should have a big, heavy hull that has trouble planing or pulling water skiers. You really need

for spring launching

more low-end torque rather than high speed and rpm. A moderate throttle burns less gas for almost the same speed.

6 Minor repairs are quick now with the new materials available, and even major patching takes much less time if you do it before going afloat instead of trying to do a makeshift job alongside a slip or at anchor.

Fill dents and gouges with epoxy putty colored with a little pigment to match the original color, although additional touch-up will probably be necessary.

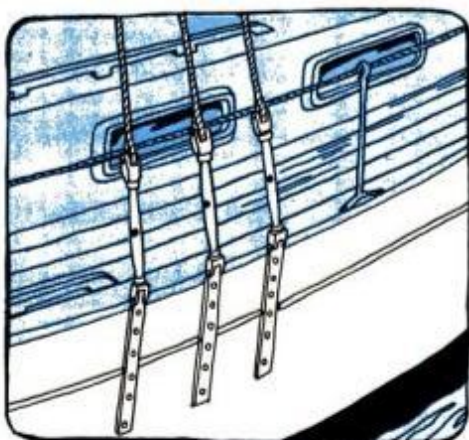
To fill larger holes, get a fiberglass repair kit from a marine or automotive dealer and build up the break with layers of mat, woven roving (fabric) and glass cloth, according to



instructions. Epoxy resin is stronger and better than polyester, but more expensive. Refasten fittings by bolting them down into the new bedding compounds.

7 Sailboat fitting-out is much like that for powercraft, but the rigging and tuning are different. Switch lines end for end to even out wear and lengthen life, but select your replacement lines using the proper synthetics—stretchables for dock and anchor lines, nonstretch types for halyards and sheets. Examine all sails for cleanliness; repair any loose stitching and tears before putting them back in service.

If you've been thinking ahead, you



marked mast position and rake at decommissioning time and can now restep it in the same location. Tighten turnbuckles of standing rigging to uniform tension, and consider chipping in with other members of a racing class to buy a clamp-on gauge that measures tightness of stays if this is critical. Proper tuning will mean more speed.

8 Now that upright flotation is considered essential for all new production powerboats, it's certainly worthwhile for your present boat as well. Foam blocks can be quickly shaped and glued or secured up under gunwales so that a swamped hull can float upright and support motor, passengers and cargo. Foamed-in-place chemicals should be used with care and in open air since some give off toxic fumes. Quantity of foam required is difficult to calculate; some builders determine the right amount with submersion tests.

The new sealants, adhesives and marine paints for boating use are usually more expensive but frequently better than similar products intended for use ashore. Seams and planking that may expand and contract with temperature or the working of a moving boat require flexible compounds that never become brittle. Polysulphides are particularly suitable.

Antifouling paints can cost \$30 a quart, but if applied according to precise instructions can keep a hull clean all season. Choose a brand that has been successful in local waters. Mask depthfinder transducers so they don't get a metallic coat.

9

Theft, unfortunately, is a problem on water, but several precautions can be taken at fitting-out time. Removable accessories should be carried ashore or secured out of sight in locked, ventilated cabinets.

Small outboard motors should be safety-chained and padlocked to the transom. A variety of locks can hold the screw clamps so the motor cannot be loosened. Larger bolt-on motors can be further immobilized by locks that fit over the fuel line plug or shut off the ignition. Take time now to record serial numbers and engrave-in identifying marks.

All newer boats have a hull identification number, which should be carefully recorded ashore. A trailered boat left in a parking lot can be chained to the tow car or a tree.

10

Maneuvering a trailered boat takes considerable practice and aids to visibility are a big help. Wide clamp-

on trailer side mirrors are useful, and another mirror in the back of a station wagon and aimed down at



the trailer hitch can help greatly in hooking up. An extra hitch clamped on the front bumper also makes launching and hauling-out easier when you must do it alone. For backing a trailer, try holding the steering wheel at the bottom; the trailer will turn in the direction you swing your hand. Don't overlook a wide-angle mirror for your runabout as well; it's great for water skiing. **PM**

Before plastic models were introduced in the early 1950s, what passed for a kit consisted of a balsa block, pieces of twine and some die-cast metal parts. You'd carefully sharpen Mom's best paring knife, and then—if you had the eyes of an eagle, the hands of a surgeon and the patience of Job—in about 2000 hours you might whittle a pretty fair replica of a Spanish galleon or a DC-3.

Expert modelers were mystics held in awe by us mortals. Hobby shops were dark little huts on back streets that survived by selling nickel balsa gliders to neighborhood kids.

The Magna Charta of modeling was the introduction of the polystyrene kit. These injection-molded plastic models were incredibly real, compared to what we were used to. Just glue the pieces together and—zap!—instant model. Every rivet, hatch cover, nut and bolt stood out in bold relief. Even the fumble-fingered could finish one, and the kits were cheap—you could count on getting two or three on every birthday or Christmas. The F-86 Sabre Jet hanging from the ceiling became as common as the baseball glove.

No one cared about super detailing. All the Air Force jets were silver, the Navy ones dark blue. The big moments were putting on the decals and sneaking a look through

Plastic models: Hobby that grew up

With the emphasis on detail and authenticity, today's plastic model kits offer challenges, satisfactions even a balsa-carver can respect.

by Peter Barmonde

the canopy just before gluing it into place. For an instant you were a Yank in the RAF, or Van Johnson in *Thirty Seconds over Tokyo*. This was the stuff dreams were made of. Hollywood provided the fantasy, but Revell actually let you touch it.

Variety and authenticity

Today, plastic modeling is still popular. In fact, it has grown and matured into a sophisticated, booming leisure activity. Fantasy is out. Authenticity and precision are in. And the hobby is definitely *not* just for kids.

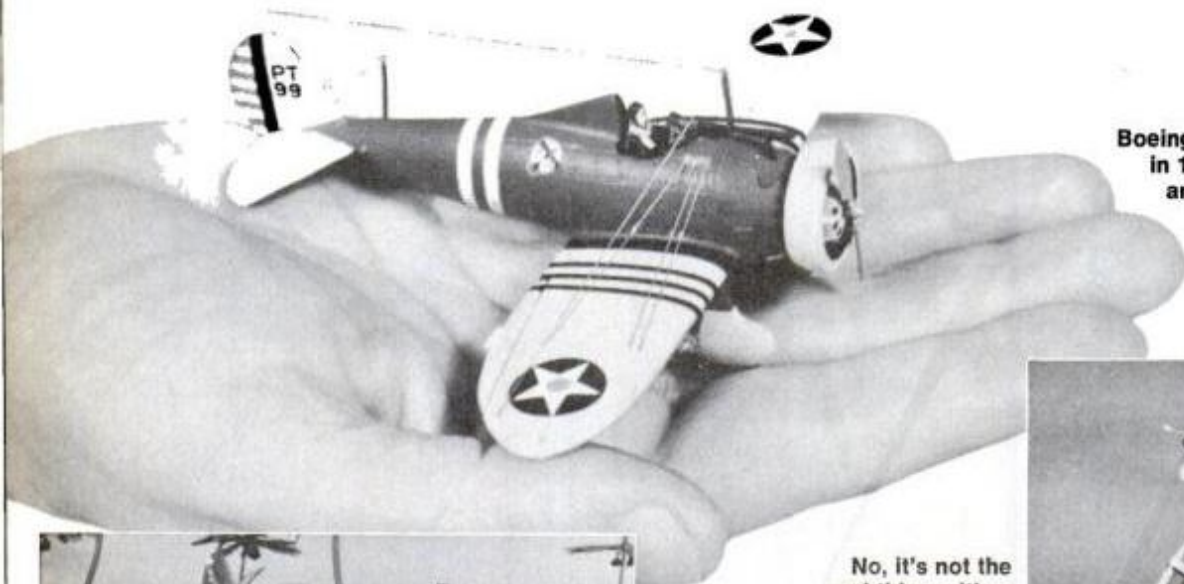
The revolution in the hobby happened in 1968, when sophisticated Japanese kits began to appear in the United States. Before that, most

plastic models were sold in toy and discount stores.

Although World War II still provides the inspiration for many modelers' efforts, it doesn't have a monopoly. Enthusiasts can choose aircraft, armor, autos, trucks, weapons, figures and ships of every conceivable type and period.

Modelers tend to specialize, and the industry has catered to this tendency. It could take years to work your way through all the 1/35-scale armor kits available today. You could make a life's work out of building just the warships that were in the Pacific Theater of World War II.

The enthusiasm generated by the advanced kits has given rise to hard-core plastic-model stores, like Squa-



Boeing P26A Peashooter fighter in 1/72 scale was assembled and finished from Revell kit by modeler Tony Lucca.

Photos by the author



P61 Black Widow showing wear of active service stars in 1/48-scale diorama.

No, it's not the real thing—it's a Harley-Davidson Sportster in 1/6 scale.



Convair B58A built from Monogram kit dwarfs scratchbuilt XF86 Goblin by George DeFronzo. Both are 1/66 scale.



Kurt Larson built this unusual 1935-vintage Mercedes-Benz truck from scratch.

Since authenticity counts, winter-white camouflage was a must for this Russian T34 tank.

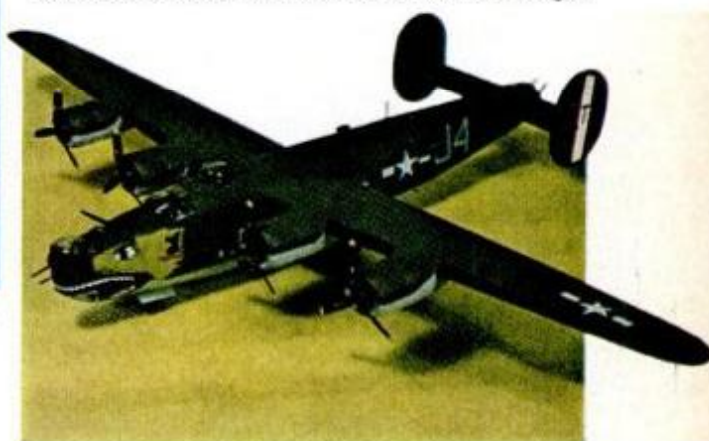


Current crop of kits, like 1/22-scale Matra MSII from MRC/Tamiya, shows fantastic detail.



Detail isn't just skin-deep—as cutaway version of Centurion tank shows.

Operational military aircraft like Consolidated B24J are detailed with authentic unit markings.



Military figures of plastic are testing the popularity of traditional cast metal soldiers.

More and more parts actually move and work in the newer large-scale kit models like this Datsun 240Z in 1/12 scale.



dron with branches in Michigan, Illinois, New York and Maryland, plus its own publishing arm (Squadron Signal Publications) and a mail-order catalog. This company has become a multimillion-dollar business in less than 10 years.

The Syosset, N.Y., store stocks a mind-boggling array of thousands of kits. Still manager Jim Katona says, "If we don't get regular shipments, this place can get cleaned out fast."

Collectors hold kits for resale

The demand for kits seems to be unlimited. People collect them like

baseball cards. They exchange them at conventions, or hold them unopened for resale. A sealed kit can appreciate rapidly after it goes out of production. Some collectors have thousands of kits and can't stop buying. "It's an obsession, I guess," confesses George DeFronzo of the Long Island Scale Model Society. "Only 70 percent of the kits sold are ever built. I have one room in my house just for storing my unbuilt models."

Those who want to build, however, should contact a local branch of the International Plastic Modelers Society. Members exchange technical

know-how and are happy to teach their techniques and tricks. The IPMS sponsors competitions and publishes an informative journal. For information, write David Terry, Membership Secretary, IPMS-USA, Box 2555, Long Beach, Calif.

There are plenty of books and pamphlets, too, to help the beginner turn out the best possible model. Squadron Signal Publications maintains its own archives, and has produced a book on almost every operational vehicle of World War II.

Today's modeler doesn't want a

(Please turn to page 207)

It's more than just snapping pieces together...

The real secret of successful model building is taking your time. Read the instructions over carefully before starting assembly—it's important to understand the procedure.

If you're a beginner, get one of the inexpensive textbooks published by kit manufacturers. Two superior ones are Microscale's *Modeler's Manual* (\$2.98) and Airfix Magazine Guide 1, *Plastic Modeling* (\$3.25).

Experienced modelers divide construction steps into subassemblies that can be painted before installation. After you've worked out your assembly procedure, examine all parts for excess plastic, called flash. Trim flash away before you remove parts from the sprue—that plastic tree to which parts come attached.

The sprue itself is useful and should be kept. Held over a candle flame, it can be stretched into thin fibers—ideal for antennae and superior to thread for rigging ships and biplanes.

Rinse all plastic parts in a solution of lukewarm water and detergent before assembly. This removes mold-release agent and promotes adhesion. Before painting, scrub parts with a kitchen cleanser like Comet to rough up surfaces and remove any residual skin oil that could keep paint from setting up.

Assembling a plastic model is like doing a jigsaw puzzle. Each part is designed to fit into a specific place; test fit each one before applying cement. Most modelers today use liquid cement; Micro Weld is the most popular brand. Hold the parts together in one hand while applying the cement directly to the joint with a fine brush. It flows into the joint by capillary action and sets up in 5 to 10 seconds—no more waiting around for glue to dry! Melted seams are gone forever, but watch out for fingerprints.

After gluing, fill in seams with a modeling putty like Micro Quik Silver or Squadron Green Putty and sand



Careful pre-assembly study of instructions and parts is key to modeling success.

smooth. Should you inadvertently remove some details, they can be restored. Pressing a sharp needle into plastic imitates raised rivets. A missing panel line can be etched in with a sharp-edged jeweler's file or an X-acto knife.

Creating an authentic finish is the culmination of the scale modeler's craft. Authenticity is achieved through study of many books and photos available in hobby shops. Companies like MRC, Humbrol, Pactra and Testors offer hundreds of colors. Kits containing all the colors needed to finish a specific item are also available—if you're building a four-engine Lancaster bomber, you can buy Humbrol's RAF European Theater paint kit.

It's wise to paint fine parts while they're still on the sprue. After main components are assembled, spray on primer to bring out glaring imperfections. Duco automotive primers are recommended. Sand smooth with 400 to 600-grit sandpaper.

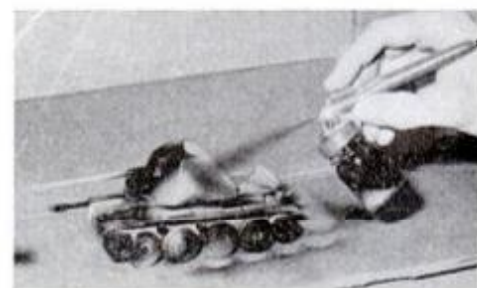
Paint lighter shades first, unless you want a darker color to bleed through. Enamel paints for plastic models dry to the touch in less than

an hour. Apply second coats of the same color while the first is still tacky; if paint has dried to the touch, wait 24 hours for complete hardening before applying any more paint.

Paint may be brushed or sprayed. If you brush, all parts or areas of one color should be done at one time to get a uniform shade. Paint should flow from the brush without leaving marks, and the second coat should be thinned more than the first, for smoothness.

You can paint with an aerosol can or, for better results, an airbrush. Cans are hard to control and their spray pattern is generally too wide. Even inexpensive airbrushes, however, have paint and airflow adjustments, giving you more positive control, greater accuracy and smoother finishes. Remember to keep any spray moving to prevent runs; when they do happen, they can be removed with silver polish.

Some finishing tricks of master modelers are: Using a liquid frisket called Micro-Mask to paint canopy ribs and elaborate camouflage. Creating weathered aluminum by rubbing silver paint with toothpaste to bring out black primer beneath, accentuating rivets and panel lines. You can also make exhaust stains with a mixture of kerosene and artist's black oil paint, use Rub 'n' Buff to get the look of worn paint, as on the leading edges of wings, weather surfaces with pastels rubbed over paint. You can even make rust with coffee grounds.—P.B.



An airbrush gives maximum control and a better finish than brush or aerosol can.

PM OWNERS REPORT: MOPEDS



by Michael Lamm WEST COAST EDITOR

The moped boom began in this country in 1975. Last year 150,000 were snapped up by eager buyers. For 1978, U.S. distributors look for sales of a quarter million or more.

The question for potential moped buyers is: What's it like to actually own and drive a moped? Do they deliver the fantastic gas mileage claimed? Are they dangerous? Practical? Reliable? Economical? What about quality and workmanship? Repairs? Riding comfort?

We queried almost 1000 owners of various makes and models in all parts of the country. Surprisingly, no age group predominated.

We tried to catch owners of all available types of mopeds, ending up with Puch, Motobecane and Batavus bikes predominating—plus a smattering of Vespa and Solex owners. Honda was just beginning distribution when we sent out our questionnaires.

First, we asked owners to list exactly what they did and didn't like about their mopeds. Some representative answers:



Mopeds can be fun. Top: Cimatti (left) and Bianchi mopeds go camping. Above (left to right): Puch, Garelli, Solex and Motobecane on the way to the beach.

PM photos: Carroll Seghers (above) and Tom Grill



Mopeds appeal to every age group—the young and old(er) alike. His and her bikes shown here are front-wheel-drive Solex and Motobecane models.

From a 15-year-old supermarket stock boy in Michigan, who owns a Motobecane 50-VL: "It gets good fuel economy, is smooth-riding, well built and quiet. What I don't like about it is its vulnerability to vandalism, no lock on the gas tank, and the cheap toolkit. Another problem, although no fault of Motobecane, is that cars don't enjoy sharing the road with people riding mopeds."

A part-time secretary from California, 21, owner of a Vespa Ciao: "I get a great feeling riding out in the open. It's a comfortable ride even on long trips. And I especially like the good gas mileage. The only thing I find disagreeable is mixing the gas and oil for the two-cycle engine. That's messy. The dealer didn't tell me about it. There also ought to be a lock on the steering column to prevent theft."

A 50-year-old consultant from Indiana: "We own two Puch mopeds—a Newport and a Maxi-S. They're great exercise, it's a pleasure to see the countryside from them and they're convenient for my wife and me for short shopping trips. Both have excellent power, are quiet and very economical. My wife says hers is a little hard to handle for a short, lightweight person."

Staff director of a Michigan historical society, mother and housewife, 39, pilot of a Motobecane: "Fun, convenient, absolutely ideal for my lifestyle doing part-time work at odd hours and lots of errands. I love it, love it, love it, but missed it this winter. My only complaint is that there's no way to

carry a passenger, so I have to use the car to take a child to the dentist, etc. This is also an advantage, of course, because it's a good excuse not to become the kids' taxi mom."

And a retired civil engineer, 71, from Massachusetts, owner of a Batavus VA Standard: "I use my moped mostly for short errands and trips within 12 miles of home. The engine always starts with the first kick of the pedal. I appreciate the wheels being fairly easy to remove and the gas tank likewise. What I dislike is that the service manual is poorly written, sketchy, incomplete and at \$15 a complete rip-off."

A little over half our respondents reported mechanical problems. Sparkplug fouling (often by vandals who put dirt or sugar in the gas tank) came in as moped owners' No. 1 problem. Electrical and carburetor ills tied for No. 2, with flat tires No. 3.

Many more moped owners did their own repair work than the car owners we usually survey. While drivers of automobiles ordinarily include about 4 percent do-it-yourselfers, moped home mechanics came in at 30.8 percent.

Those who let dealers service their machines rated the mechanics good to excellent by an impressive 80.6 percent. A few owners volunteered that their dealers gave mechanical advice over the phone—something auto service people never do. And a tiny percentage mentioned parts being hard to get—a problem with imported cars as well.



Late moped models show experimentation with different layouts—e.g., rear-mounted tank on Motobecane's new model 7 Motobecane VLX shown goes all out to look like a motocrosser.

Most moped riders don't wear helmets; 76.7 percent said they never do. Concerning safety, a medical researcher in New Jersey said, "Car drivers simply don't register on the fact that mopeds exist and move. I feel that only licensed drivers should be able to drive mopeds, because a knowledge of traffic rules is absolutely essential; e.g. who has the right of way, what to do in emergencies, etc."

What about quality of construction and workmanship? "Very good, strong frame and well-engineered



Many owners use mopeds for errands and commuting; worry about theft and vandalism. Shown is Scorpion's SC-2X.

engine," says a New York auto mechanic of his Puch. A New Jersey chef and Motobecane owner: "Many of the other brands of mopeds I tried seemed less sturdy." And a Massachusetts machine operator and Motobecane driver comments, "Just to give you an idea of how sturdy this moped is, the first day I rode it, my lock chain got caught between the rear tire and the frame.



Tennis player looks happy on a Vespa Ciao, but frequent criticism (of all mopeds in survey) focuses on saddle—more comfortable design is wanted.

I was going about 25 mph. I stopped pretty fast, but nothing happened—nothing broke or bent. I carry the chain in a safer place now."

Many owners bought their mopeds for environmental and conservation reasons. An Indiana bar manager: "I use it every chance I get . . . to save gas and because it's fun, cheap and handy."

A California school administrator says, "Our nation needs to start using people movers as a mode of personal transportation—to save fuel and prevent pollution. I believe mopeds are one answer. Our family of five loves our three mopeds (two Puchs and one Garelli). We average 120 mpg with the Puchs and 85 mpg with the Garelli, and we leave our cars at home whenever we can."

"It's a practical vehicle to use on campus," adds a Maryland college student and Batavus owner, "because there's never any parking problem. I can be at class or back in the dorm while people in cars are still circling the parking lot."



Puch Maxi riders take a break. Owners in our survey found their machines very well put together. A full 70.5 percent found workmanship excellent; another 24.8 percent found it good. Compare these figures to those for PM's automobile owners reports.

More comfortable seats and turn signals were two items oft-mentioned by mopedalers who made recommendations for improvements. Seats were often judged too firm, too lumpy or too high.

As for turn signals, a college student suggested: "Signal lamps don't have enough candlepower—need to be at least 21 watts instead of the 10 watts as installed."

A "lady of leisure" from Maryland added: "I wish turn signals were standard equipment," she said, "because I opted not to get them on my Batavus. I'm sorry every time I turn; other drivers don't always recognize hand signals. Besides, it's a pain to keep one arm in the air, and it makes it hard to brake."

Other suggested improvements:

"Three main things all mopeds should be required to have," proposes a Massachusetts designer, "are a two-speed automatic transmission with gear and not belt drive, a six-volt battery to maintain constant lighting when idling, and a least a gallon of fuel capacity."

"The horn should be louder," avers a Maine housewife. "With the headlight on, it barely bleats."

"I would like to see a moped lane on major thoroughfares," notes a California customer service rep. "I bought my Motobecane mostly to save money. I sold my second car and have already saved the price of the moped in gas, maintenance, and insurance. The bike saves me 30 minutes a day in commuting time by bypassing a lot of traffic." **PM**

SUMMARY OF LATE-MODEL MOPED OWNERS REPORTS*

Total miles driven	135,386	One-way distance—camping, touring:		Average	3.9	Fair	4.6
Average miles per gallon	102.8	Average miles	55.9	Fair	0.0	Poor	5.6
		Longest trip, miles	450.0	Poor	0.8		
Makes of mopeds owned:		Specific likes:		Had any mechanical trouble?		Number of mopeds owned:	
Puch	34.8%	Economy	54.1%	Yes	52.8%	One moped	83.1%
Motobecane	32.6	Handling	25.4	No	47.2	Two mopeds	16.2
Batavus	25.8	Ride	24.6			Three or more mopeds	0.8
Vespa	3.8	Performance	15.6	What type of trouble?		Others in family use your moped?	
Solex	1.5	Styling	15.6	Sparkplugs	16.7%	No	51.9%
				Electrical	15.2	Yes	48.1
Why did you buy a moped?		Specific dislikes:		Carburetor	15.2	Do you wear a helmet when riding?	
For fun and recreation	49.2%	Not enough power	19.5%	Flat tires	12.1	Yes, always	12.4%
For economy	38.3	Uncomfortable seat	9.7	Did you repair it yourself?		Yes, sometimes	10.9
For transportation	18.8	Lack of turn signals	8.8	No	69.2%	No, never	76.7
For commuting	7.8			Yes	30.8	Age distribution of owners:	
For what do you use your moped?		What changes would you like?		Dealer repairs satisfactory?		15-29 years	34.9%
Pleasure and errands	49.6%	More comfortable seat	14.7%	Yes	83.0%	30-49 years	35.7
Commuting	22.1	Turn signals s'd. eqpt.	14.7	No	17.0	50-plus	29.5
All above	28.2	More horsepower	9.5	Dealer service opinion:		Would you buy another moped	
One-way distance—commuting:		Better electrical system	6.9	Excellent	46.3%	of the same brand next time?	
Average miles	6.6	Workmanship opinion:		Good	34.3	Yes	86.3%
Longest trip, miles	35.0	Excellent	70.5%	Average	9.3	No	13.7
		Good	24.8				

*Percentages might not equal 100% due to rounding or insufficient data.

5 great ways to solve kitchen storage problems

From PM's workshop—handsome quickie projects for improving kitchen living.

by Harry Wicks HOME AND SHOP EDITOR

A problem in many kitchens these days is that there is no convenient place to store all the cooking items and household aids you use daily. Many of us toss tableware in a drawer or push household cleaners under the sink in willy-nilly fashion. Pads, pencils and telephone books are usually stuffed wherever space can be found. This can be frustrating when you're in a hurry to look up a number or need a scrap of paper to jot down a reminder note.

Plainly, most of us can use all the storage space we can muster. So we asked designer Gary Gerber, IDSA, to create the projects shown on the facing page. All five are designed to solve specific storage problems—and all of them are attractive. In fact, all can be installed in plain view as decorative accessories.

Complete plans and instructions for building these projects are given on this and following pages.

1. Home office organizer

The unit is sized to suit the classified telephone directory. So before you cut material, measure your local Yellow Pages and adjust drawer and box dimensions if necessary. We built a two-drawer unit in the PM shop to fit under a double wall cabinet. More one-drawer units can be built if you want to add storage in your home office center.

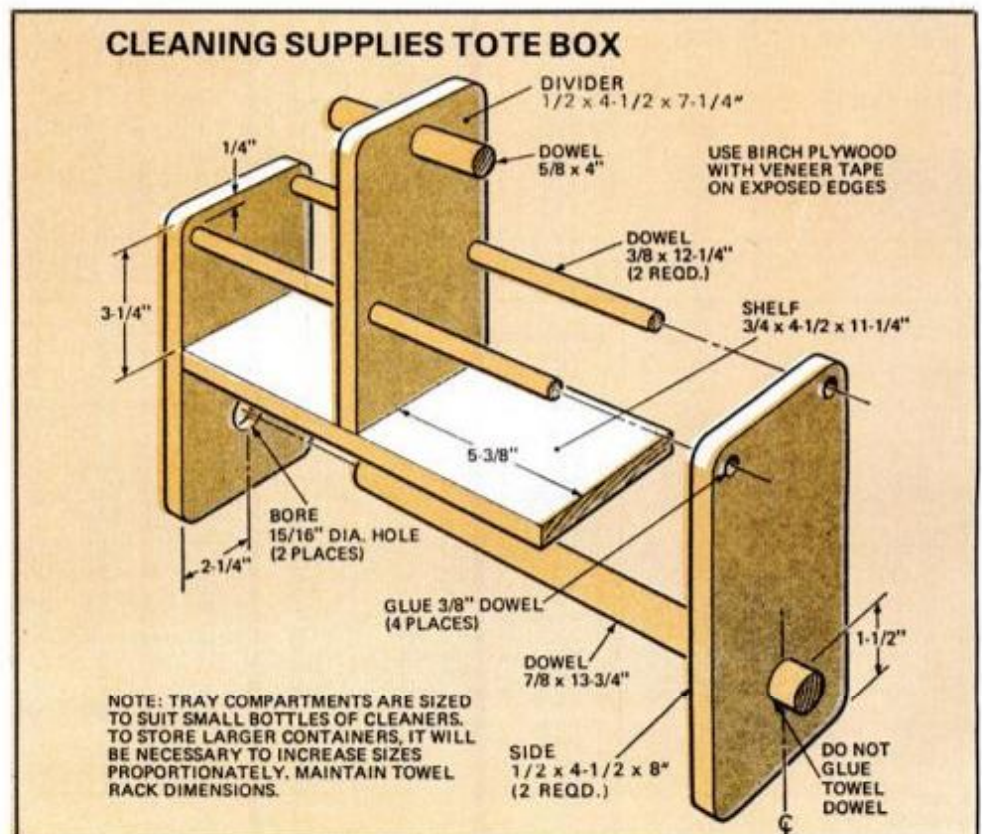
Start by cutting all parts to size as indicated on page 114. The box consists of top and sides (ends) only. Since the drawer fronts conceal the entire box, there is no need to waste materials on a back or bottom. Before assembly, secure the wood strips that serve as drawer guides

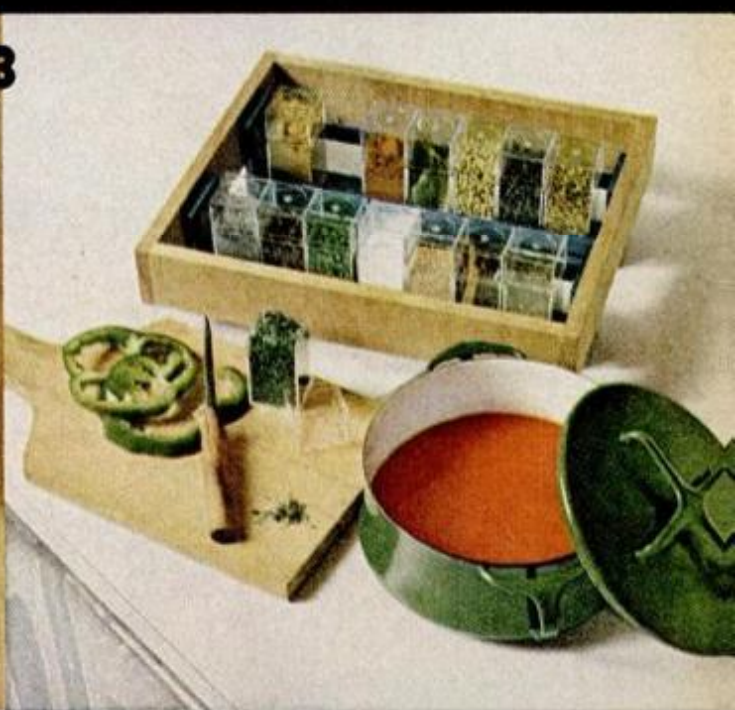
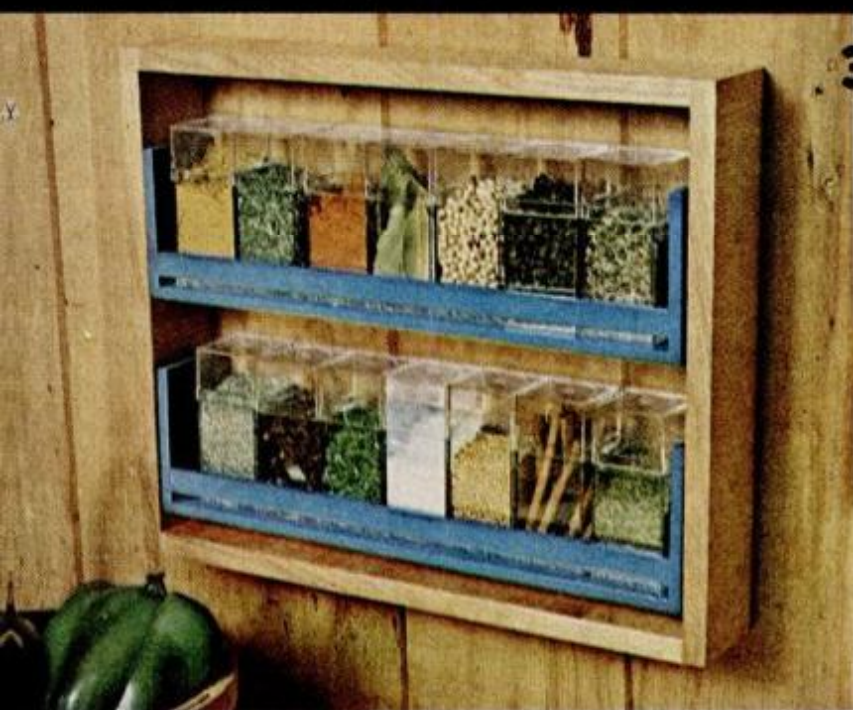
on the ends and center divider. Next, attach vertical members to the top using carpenter's glue and 1¼-in. flathead screws. Note that the divider is centered exactly.

Once the unit is assembled, check dimensions and build identical drawers to suit the openings. To make one a portable "secretary," install cleats on the inside surface of the drawer sides and fit in a sheet of ¼-in. hardboard for use as a writing surface. Groove the drawer front and sides to receive the drawer bottom, but cut the drawer back nar-

All these projects are designed with function as well as appearance in mind.

1. Kitchen organizer consists of twin drawers in a box affixed to a wall-cabinet bottom. Drawers serve as a home office center and keep paper, pencils, Yellow Pages near wall phone. 2. Spice rack with serving tray doubles as attractive wall graphic. 3. Our swivel spice rack stores on wall (near right), then shelves pivot on dowels to keep bottles erect when unit is carried to table (far right). 4. Tableware caddy is modern version of colonial silver trays. Its fabric removes for washing. 5. A handy tote box for cleaning supplies.



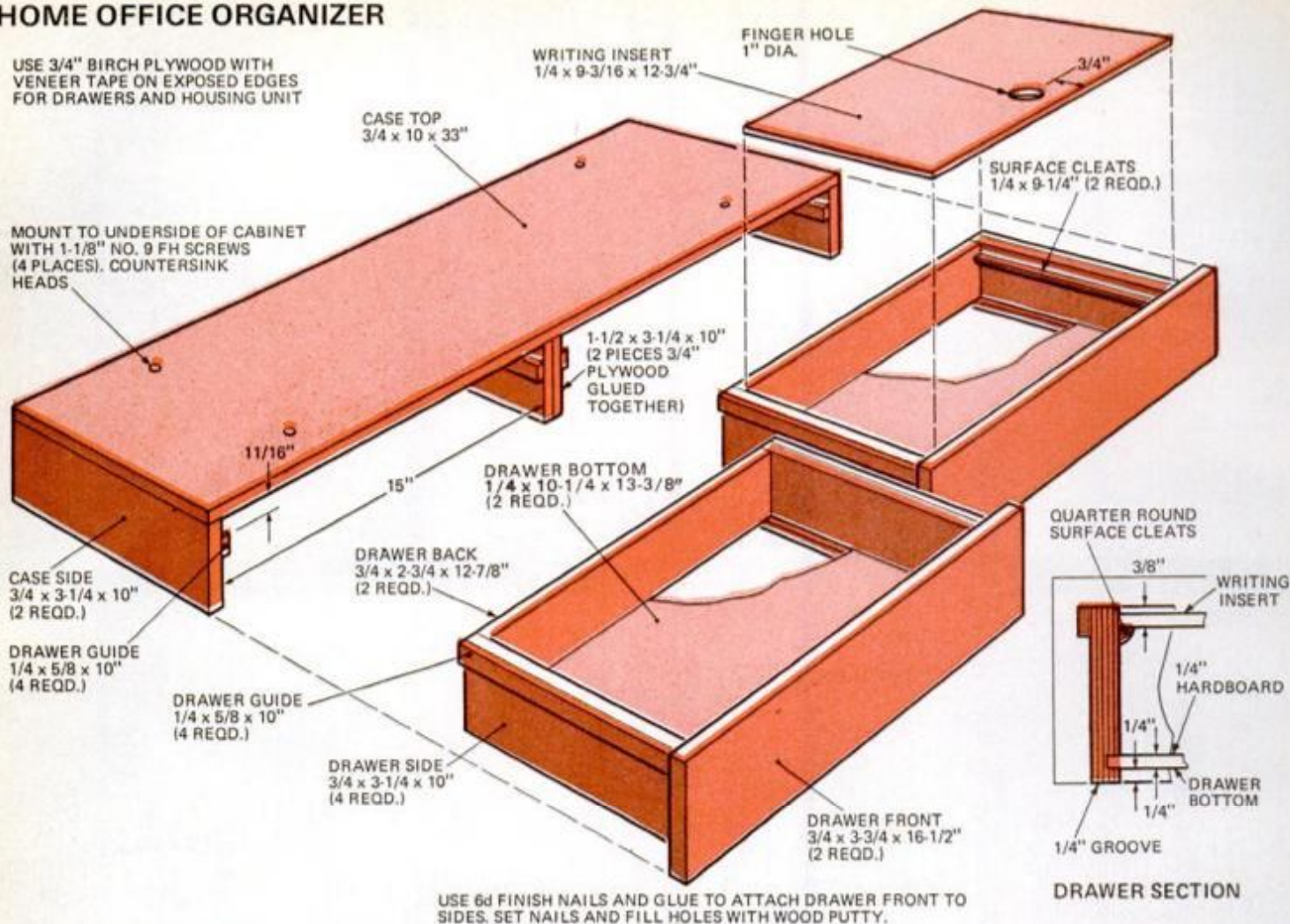


PM photos: George Raital

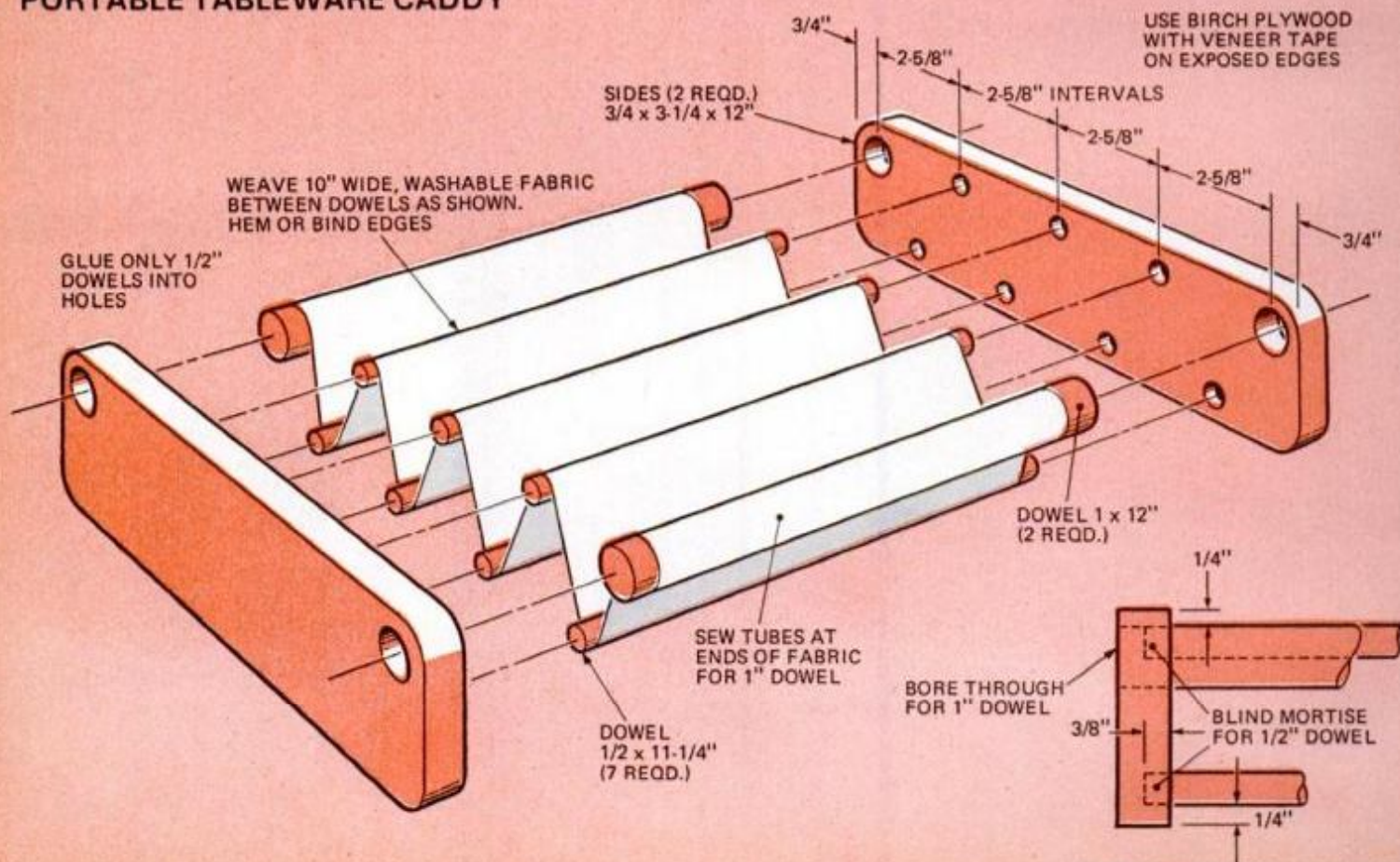
Материал, защищенный авторским правом

HOME OFFICE ORGANIZER

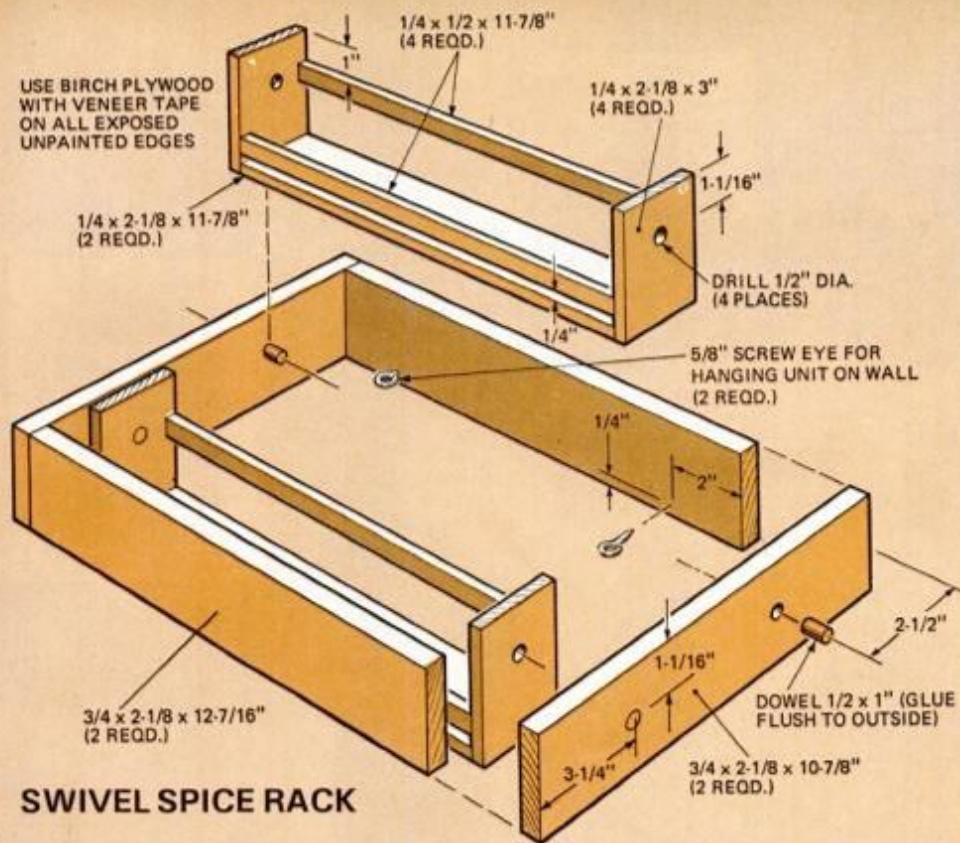
USE 3/4" BIRCH PLYWOOD WITH VENEER TAPE ON EXPOSED EDGES FOR DRAWERS AND HOUSING UNIT



PORTABLE TABLEWARE CADDY

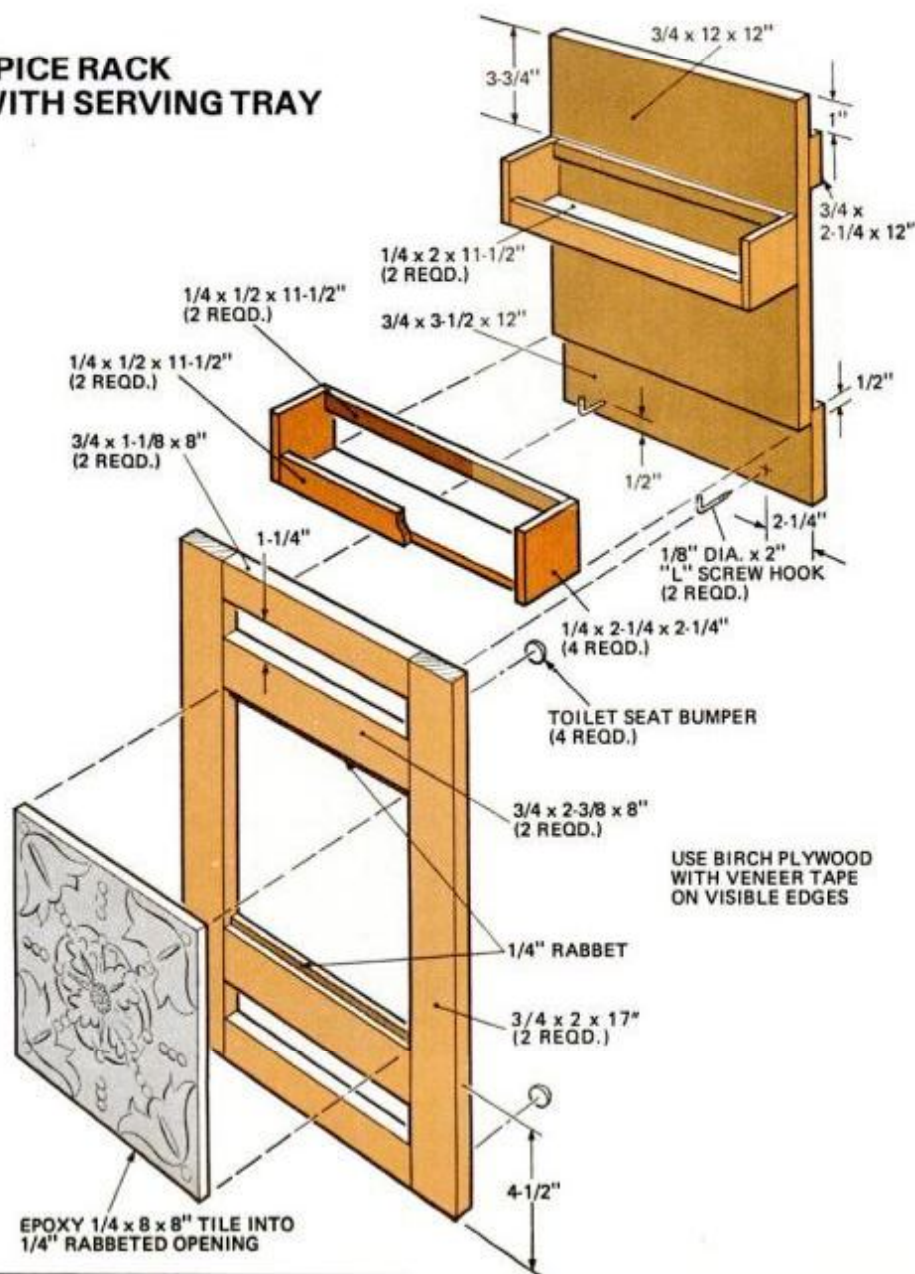


USE BIRCH PLYWOOD WITH VENEER TAPE ON ALL EXPOSED UNPAINTED EDGES



SWIVEL SPICE RACK

SPICE RACK WITH SERVING TRAY



rower so it will rest atop the drawer bottom as shown. Secure the bottom in grooves with glue and finish it off by driving brads through the bottom up into the drawer back. Repeat for second drawer.

Hold the box in place under the cabinet to which it will be attached. If your cabinet has side, front and back projections beneath the cabinet bottom, you will need to measure the space created when the box butts these surfaces. Then cut four spacer blocks to fill the gap, predrill holes through them, and hang the box by turning screws through the box top and spacer blocks into cabinet above.

Sand units and install veneer tape on all exposed plywood edges. Finish with the stain of your choice and two coats of polyurethane varnish.

2. Spice rack with tray

For the tray shown, the back pieces are $\frac{3}{4}$ -in. birch plywood, while the spice racks are $\frac{1}{2}$ -in. and $\frac{1}{4}$ -in. (lattice) pine. Cut the plywood parts to size and assemble using white glue and 3d finishing nails (from the back). Apply veneer tape to the exposed plywood edges and sand the unit thoroughly. Install two screw eyes at the top for hanging the unit on the wall and two L-hooks below for accepting the cheese tray.

Next, cut the pine pieces and assemble the spice shelves with white glue and small brads. Sand and stain the shelves (we used a stain to match the brown in the tile). Mount them on the birch frame using white glue and brads from the back. To finish, wipe the unit with a tack rag and apply two coats of urethane varnish.

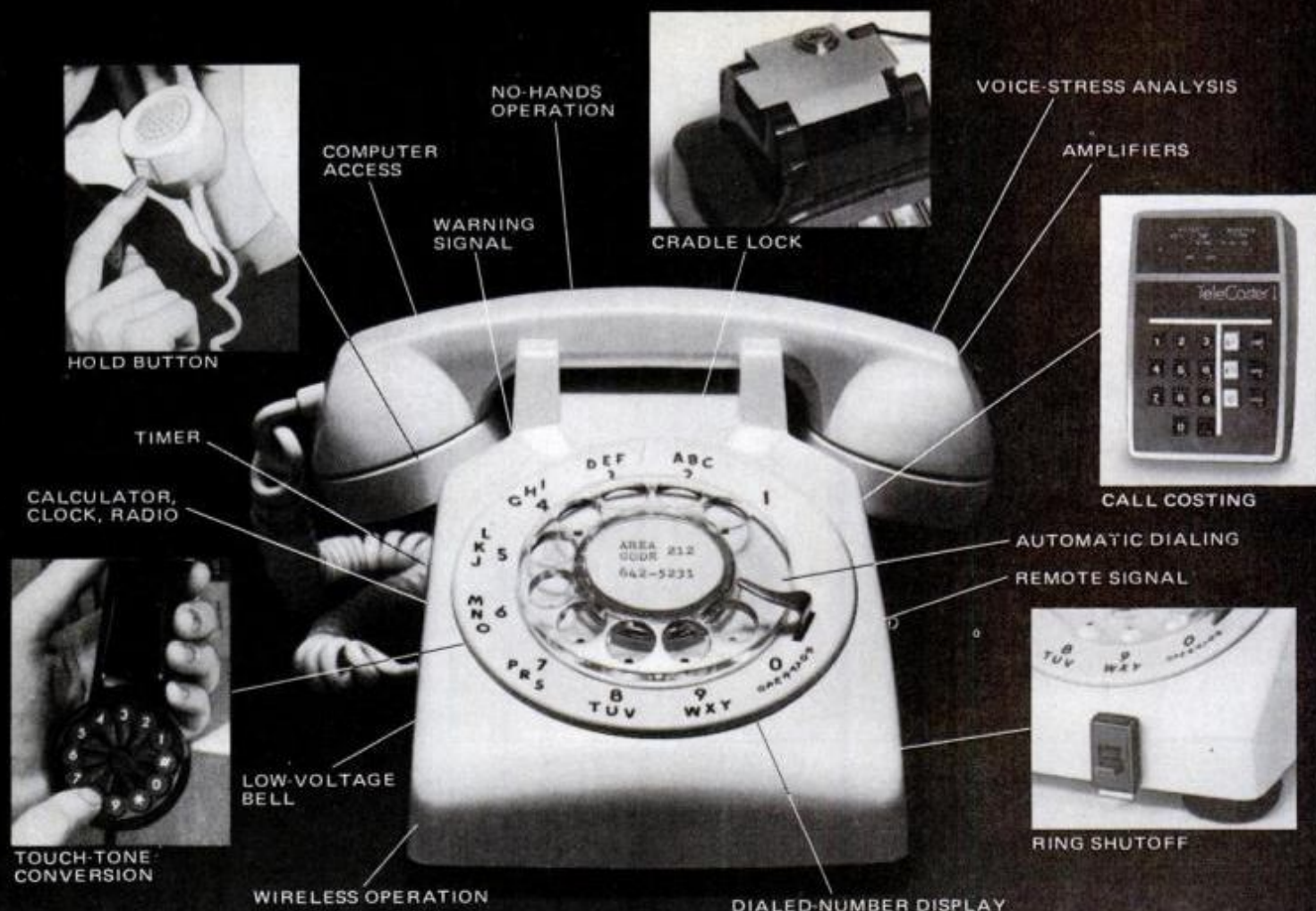
To make the serving tray, cut birch plywood and hardboard parts to size. Then rabbet the two cross-pieces to hold the ceramic tile. Assemble the frame with white glue and 6d finishing nails. Glue veneer tape to all exposed plywood edges. Use an adhesive intended for porous materials (epoxy or 3M's Super-strength Adhesive) to glue the ceramic tile in place. Finish the wood parts to match the wall unit.

3. Portable spice rack

Measure the spice bottles you plan to use and size the rack to fit. Build the frame using birch plywood and assemble with white glue and well-set 6d finishing nails.

Sand the unit and dust. Install screw eyes for hanging. Bore $\frac{1}{2}$ -in.-dia. holes for the dowel pivot rods. Enlarge holes slightly with a rat-tail file for easy swinging (or bore $\frac{9}{16}$ -in. instead of $\frac{1}{2}$ -in.-dia. holes).

Assemble the pine pieces with glue (Please turn to page 194)



Superphone: New ways to make your phone do more, better

Inexpensive accessories and new telephones offer extra functions, more convenience.

by Dave Sagarin

When my grandfather finally allowed a "telephone instrument" in his home, in the 1920s, it was for emergencies only. A telephone wasn't for frivolous use. Well, times have changed.

For many years, the Bell System telephone companies took a restrictive and paternalistic line with us, permitting nothing but company-issue hardware to be connected to their lines and equipment. But re-

cent legal decisions have broken the field wide open, and now there's a growing number of useful and interesting devices available to make your phone do what it always did, only better, as well as to teach it new tricks.

Answering machines are everywhere now. There are too many to list here, and they're widely available. Upstayed telephones are becoming commoner too. But whether offered by the phone companies or by other suppliers, they're merely a way of prettying up the basic telephone unit.

Far more intriguing are the gadgets that actually extend the telephone's capabilities. Some are add-on accessories and some are built into replacement phones. Of the accessories, some require connection to a

terminal block inside the phone, while others are screw-on replacements for standard telephone parts. None takes great skill or much time to install. Here's a potpourri of new devices:

The Soft Touch is a pushbutton conversion pad that replaces the mouthpiece and microphone of a standard phone. Working like a Bell System Touchtone pad, it converts a dial phone to pushbutton use anywhere the local exchange accepts Touchtone signals, and lets you communicate with the new computerized electronic banking systems. Voice transmission is unaffected. It's \$30.

There are several telephone amplifiers on the market, ranging from add-on units by Radio Shack for less than \$16 to a complete phone with built-in speaker for \$250 from Phone



Sound Switch is a partial hold-button that takes microphone out of circuit.



The Silencer gives privacy, prevents interruptions by shutting off phone's bell.



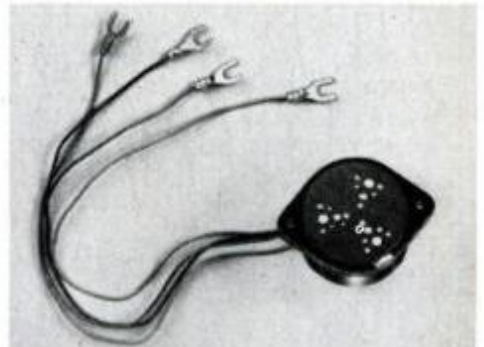
Compact tone-generator and microphone, Soft Touch replaces old mouthpiece.



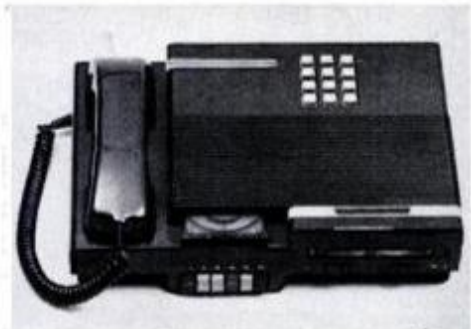
Phone Lock on cradle prevents unauthorized use of even pushbutton telephones.



Liberty Light minds phone bill by flashing red light when call goes on too long.



Low-voltage Bel-Ringer replaces jangling bell with softer electronic tone.



Phone-and-recorder combination is part of line of phones newly offered by ITT.



ITT's Security Phone lets you call police, fire department with push of one button.



Computer-Phone displays running total of local or long-distance call costs.

City. They're useful if you want to talk while using your hands for something else (in the shop or dark-room, for instance) or to let several people in a room talk and hear at the same time. You'll sound as though you're in a barrel, though—and don't all talk at once.

It's easy to prevent unwanted outgoing calls on dial-type telephones with an inexpensive lock in a hole in the dial face. But what about push-button phones? Eico offers an electronic combination lock for \$20, and DataLink sells the Phone Lock, which mechanically locks the receiver cradle, for \$5.50.

The Silencer, from Zoom Telephonics, answers a long-felt need: For \$10 you get a switch that turns the damned thing off. The caller hears a normal ring—you hear nothing.

(I'd like to see them add a timer, so the phone comes back on after a preset interval, or perhaps a flashing light-emitting diode to remind you that you're incommunicado.)

The Stereophone, by Triamics and available at Phone City, replaces your earpiece with a two-part, cord-connected device that splits the incoming sound—one part of the device and one part of the sound for each ear. This gives a slight stereo effect but, more important, helps screen out noise.

If you are in the habit of making remarks to others present that you don't want your caller to overhear, get a mute. The Sound Switch, from Vinman's for \$3.50, is a replacement mouthpiece with a built-in switch that cuts out your microphone, but

(the really sneaky part) still lets you hear what's being said on the other end.

For \$7.50, you can get Touchables—extra-large pushbuttons on a plate that covers your Touchtone keypad. They could be of help to those who have trouble with the standard buttons.

The Bel-Ringer replaces your bell with an electronic tone, and operates at a lower voltage than a bell does. I won't say why you'd ever want one, but one way the phone company detects unauthorized, user-added extensions is by the voltage drop which results when extra bells are ringing.

Several companies offer a little light that goes on when someone is listening in on an extension. Phone-

(Please turn to page 224)

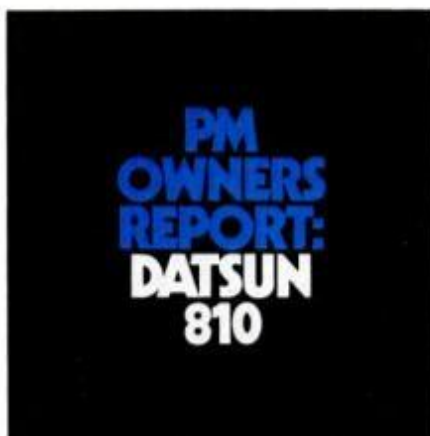
When Datsun introduced its 810 exactly a year ago, the company announced that the car would aim at the general market occupied by Granada, Volare, Concord and Nova.

The motoring press, though, disagreed and put the 810 into the class that includes BMW, Alfa Romeo and the Audi 5000. Writers agreed that beneath the 810's conservative exterior beats the heart of a sports sedan, not just that of a family bus.

The 810's engine is an updated, fuel-injected version of the Datsun 240-Z's overhead-cam Six. Independent rear suspension, disc brakes, variable-ratio manual steering, steel-belted radials, plus an impressive list of additional standard equipment elevate the 810 not only above most middle-class American



Sedans have hot setup with independent rear suspension; wagons don't.



cars, but above any rival in its price class (\$5968 p.o.e. West Coast).

For that amount, you get (among other items) a tach, digital quartz clock, AM-FM multiplex stereo, full instrumentation, central warning system, reclining seats, adjustable steering column, rear-seat armrest, backlight heater, console and a whole lot more. Power steering is also standard on '78 models.

Options include airconditioning and three-speed automatic. The 810 comes as a wagon, too, but the wagon has a one-piece rear axle instead of the sedan's i.r.s., so that heavy loads don't make the rear end squat.

As with all our Owners Reports,

we surveyed 1000 buyers and asked each of them to list their experiences with the 810; their likes, dislikes and opinions on workmanship, dealer service, comfort, and all the other categories listed on our summary chart on page 120.

Rather than present owner opinions by category here in the text, though, we'd like to let a handful of owners with typical and representative comments speak for the majority.

First, a California biochemist, a wagon owner, 41: "I bought



Drivers like instruments and controls, but want a better ventilation system.

my 810 because I like the car's size; also because of Datsun's good reputation and favorable magazine reports. I especially like the car's

by Michael Lamm WEST COAST EDITOR



Trunk meets owners' needs easily.

Independent rear suspension gives the 810 sporty sedan handling.

Size of the 810 convinced many owners to buy (wheelbase is 104.3 inches).



Rear-seat passengers fare well for car that the EPA considers a subcompact.

use of space, its mechanical quality and dependability. My only problem in 7050 miles has been the failure of the rear-window washer/wiper. The dealer has stalled me until the next service comes due, and from my limited contact with him, I'd rate his service department fair. Gripes? Ventilation needs work, because as it is now, I have to either open a window or turn on the airconditioning compressor. Also the radio—eliminate it or replace it with a decent one."

An Illinois ophthalmologist, 29, owner of an 810 sedan: "Exterior is smaller than most U.S. cars, yet it's sufficiently large inside. That's the main reason I chose this car. I find

handling, braking, etc., excellent. Datsun enjoys a superb repair rate. I'm getting 16 mpg in town and 18 to 20 on the highway with automatic—not bad, but the automatic makes the engine a little sluggish. I'm very tall and thus feel a slight discomfort on long trips. It would be nice if Datsun could move the floorboard forward slightly—but I find this a problem in all cars. I particularly like the 810's handling, brakes, sturdiness and acceleration except from standstill. My only repair has been the lock on the driver's door. The dealer fixed it with no problem and no charge."

An anthropology professor in Kentucky, 34, driving a sedan with four-speed: "I bought my 810 be-



Fuel mileage of Six ranges from 16.9 to 23.2 mpg; owners want even more.

cause I found it offered the best quality for the price. Datsun also has a good reputation for mechanical dependability, and I got an excellent deal. I've had no mechanical problems at all (6500 miles); am getting 20.5 mpg in town, 28 on the highway. I rate exterior workmanship excellent and interior good to very good. As for changes, I'd like to see Datsun offer a five-speed overdrive transmission, better radio, and improved styling. I enjoy the car's power and economy, the full instrumentation, overall quality of workmanship, and the electronic ignition and fuel injection."

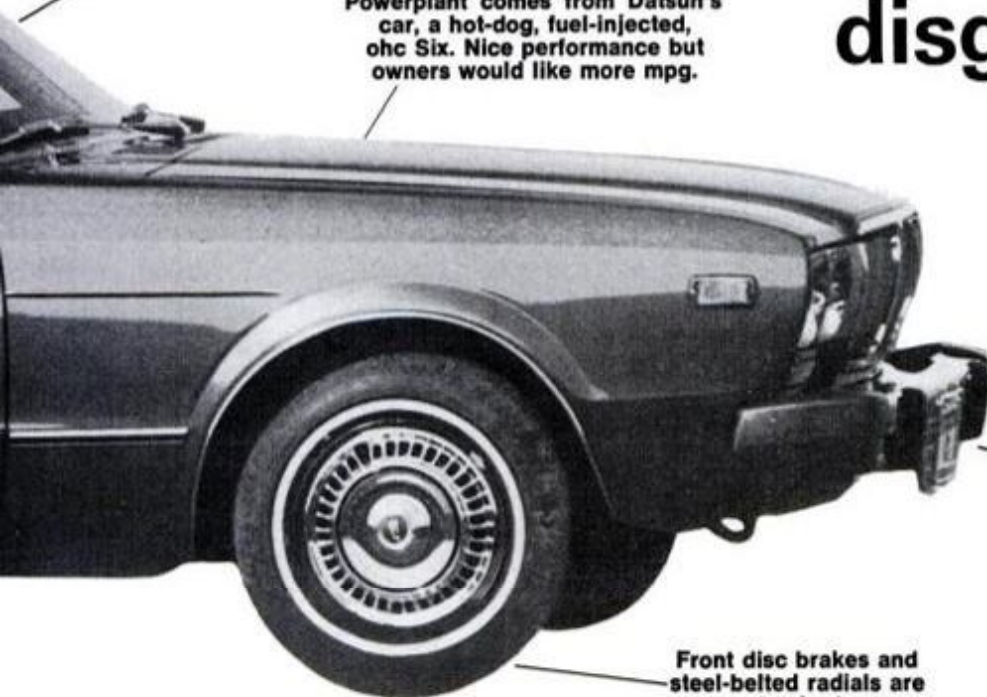
A 23-year-old registered nurse from New York: "I wanted a small car, not sporty, that had a lot of pep—more than can be found in a four-cylinder engine. I've had absolutely no problems and rate dealer service as excellent. I especially like the luxurious interior, maneuverability and comfort. Acceleration when entering freeways is good, and I love all the extras that are standard. Of gripes—my gas mileage is less than expected (sedan with automatic), and I have a definite surge when the transmission shifts from first to second. Of changes—the styling is sort of plain. Comfort

A NATIONWIDE SURVEY BASED ON 1,700,000 OWNER-DRIVEN MILES

Good visibility, full instrumentation and long list of standard equipment make owners happy.

Powerplant comes from Datsun's car, a hot-dog, fuel-injected, ohc Six. Nice performance but owners would like more mpg.

Neat-handling sports sedan is disguised as a family car



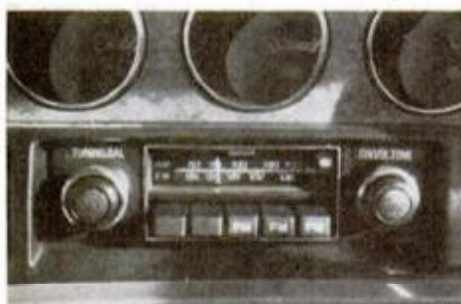
Styling divides owners—many like it but some want more pizzazz.

Front disc brakes and steel-belted radials are standard.

front and rear, though, is excellent. Four of us took a three-hour drive upstate, and we all had more than enough room—no backaches or sore leg muscles."

A Texas drive-in operator, 43, owner of a manual sedan: "I bought the car for good gas mileage combined with good performance—got both. I average 20 to 21 mpg around town and 27 to 28 out on the highway. I'd like to see Datsun improve the ventilation system so the blower doesn't have to be on most of the time; also a larger trunk. But dealer service, comfort and workmanship rate good in my book."

And finally, these comments from a Michigan data-processing manager, aged 33, owner of a four-door with automatic: "It's the only small car on the market with enough room, power and a good ride—that's why I bought it. Workmanship is good, but I wish



A higher quality AM/FM radio rather than the Hitachi that comes standard in the 810 is wish of some audiophile owners.

they'd put less plastic inside. I've had no need for repairs and find my dealer's service department good—always on time. Comfort is excellent in the adjustable front seats and very good in the rear seat. I like the 810's comfort and performance. It has everything you could ask for except cruise control, which sometimes gets you speeding tickets anyhow. I've got no complaints, because it's an excellent all-around exceptional car." **FM**

PM driver finds 810 suits family

"It's really a little *luxury* car!" That praise for my new Datsun 810 wagon came from a neighbor who drives the largest, most option-packed station wagon made.

My wife, after making the transition from our vintage-1969 veteran of 100,000 miles, is anxious to drive the Datsun across the country.

And a son, who really didn't have

stumbling or coughing when reckless folk drive off too hastily with a cold engine.

This cold-weather, short-trip driving averaged a bit above 17 mpg; a longer trip last fall yielded 22.2 mpg. While the automatic transmission tends to erode mileage figures, I suspect a dazzling array of family driving habits also took their toll.



Lift-up door gives us easy access to cargo area for hauling sail bags, other gear.

Datsun on his mind until the 810 arrived, became so enchanted with the Z engine that he bought a used 240Z.

The adoption of this lively 810 as our primary family car has gone remarkably well. There's hardly anything to complain about. The biggest problem so far was a heater control that jammed. (It was fixed under warranty, of course.)

We've driven the 810 slightly more than 6400 miles. It was kept outdoors in this recent, most miserable of winters, and the fuel-injected engine fired up every morning at the first turn of the key. Even at near-zero temperatures, there's no

My own particular joy in driving the 810 is that I feel I have everything under my control.

If I need a snappy getaway, it's there; so is a fast dash around a truck at speed on the highway. And braking is smooth and quick.

The handsome, highly legible instrument panel gives precise engine information—actual voltage and oil pressure, for example—and the cluster of warning lamps tells me that battery fluid is okay, fuel is above the danger level, all doors are tightly closed and so on.

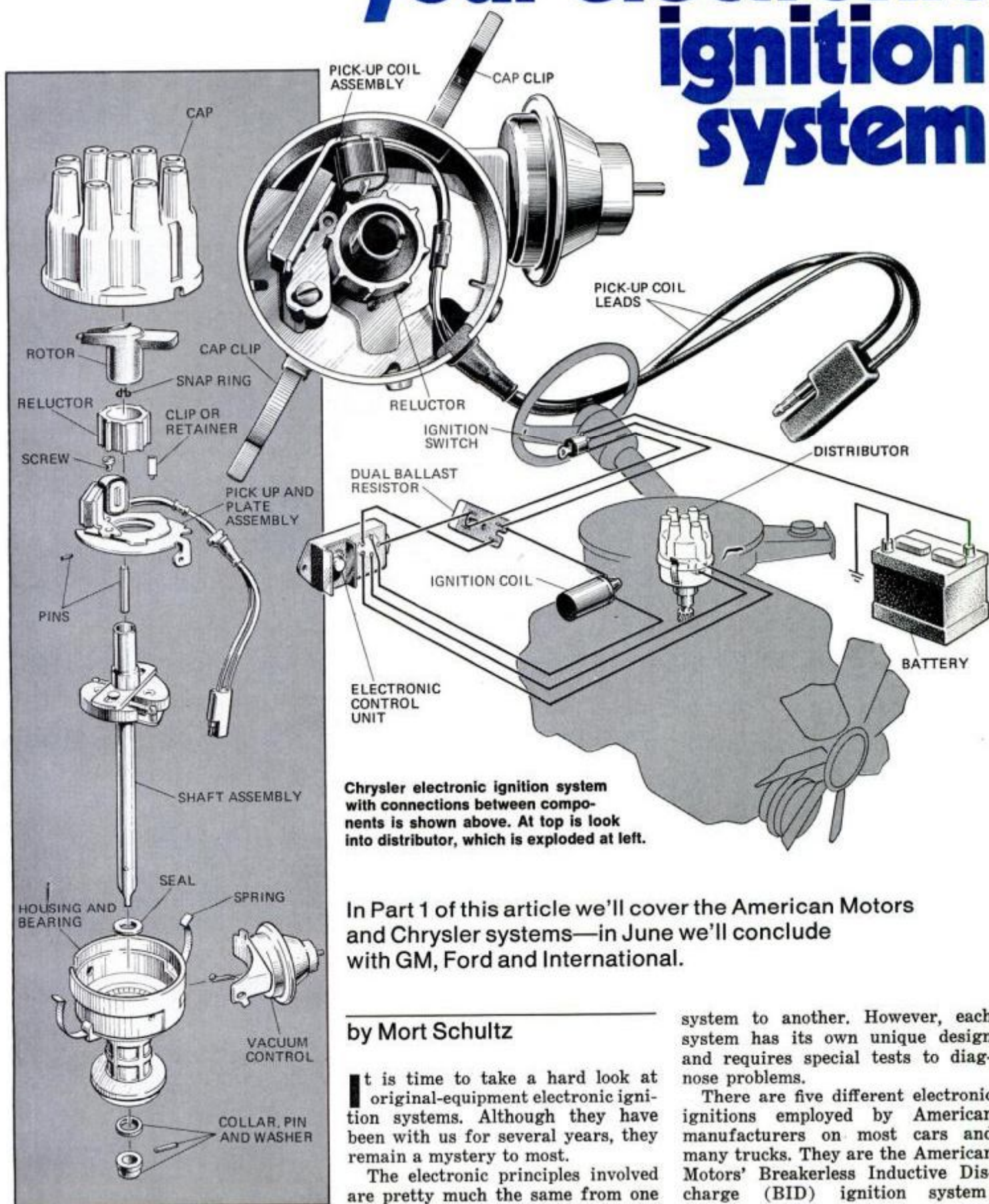
In all, the 810 has been a pleasant introduction to ownership of a foreign car.—*John Linkletter*

SUMMARY OF 1978 DATSUN 810 OWNERS REPORTS*

Total miles driven	1,696,714	Comfort	28.1	Good	13.1	Dealer service opinion:	
Average miles per gallon		Performance	25.0	Fair	2.8	Excellent	27.8%
Four-speed transmission		Power	18.4	Poor	1.0	Good	39.5
In town (EPA: 16 mpg)	18.1	Specific dislikes:		Comfort opinion (rear seats):		Average	15.2
Long trips (EPA: 23 mpg)	23.2	Gas mileage	25.9%	Excellent	19.7%	Fair	6.1
Automatic transmission		Poor ventilation system	11.7	Very good	34.6	Poor	11.4
In town	16.9	Rattles	8.9	Good	31.2	Number of vehicles owned:	
Long trips	20.5	Airconditioner	7.1	Fair	10.8	Datsun 810 only	35.5%
Transmission choices:		Transmission	7.1	Poor	3.7	Two cars	50.5
Automatic	71.8%	What changes would you like?		Had any mechanical trouble?		Three cars	11.6
Four-speed manual	28.2	Better vent system	16.8%	No	62.4%	Four or more cars	2.3
Body style choices:		Better gas mileage	11.1	Yes	37.6	Makes of other cars owned:	
Four-door sedan	57.5%	Jazzier styling	8.2	What type of trouble?		Datsun	23.3%
Five-door wagon	42.5	Transmission	6.1	Airconditioner	15.7%	Chevrolet	17.5
Why did you choose Datsun 810?		Workmanship opinion:		Transmission	13.0	Ford	10.1
Size	37.8%	Excellent	56.0%	Shift	10.2	Volkswagen	9.0
Economy	27.9	Good	36.1	Electrical	8.3	Toyota	6.9
Styling	24.0	Average	4.8	Did you repair it yourself?		Age distribution of owners:	
Performance	18.4	Fair	2.1	No	97.2%	15-29 years	17.9%
Reputation	17.0	Poor	1.0	Yes	2.8	30-49 years	45.9
Specific likes:		Comfort opinion (front seats):		Dealer repairs satisfactory?		50-plus	36.2
Handling	48.3%	Excellent	45.5%	Yes	51.7%	Would you buy another Datsun 810?	
Styling	28.5	Very good	37.6	No	48.3	Yes	77.5%
						No	22.5

*Percentage might not equal 100% due to rounding or insufficient data.

How to troubleshoot your electronic ignition system



Chrysler electronic ignition system with connections between components is shown above. At top is look into distributor, which is exploded at left.

In Part 1 of this article we'll cover the American Motors and Chrysler systems—in June we'll conclude with GM, Ford and International.

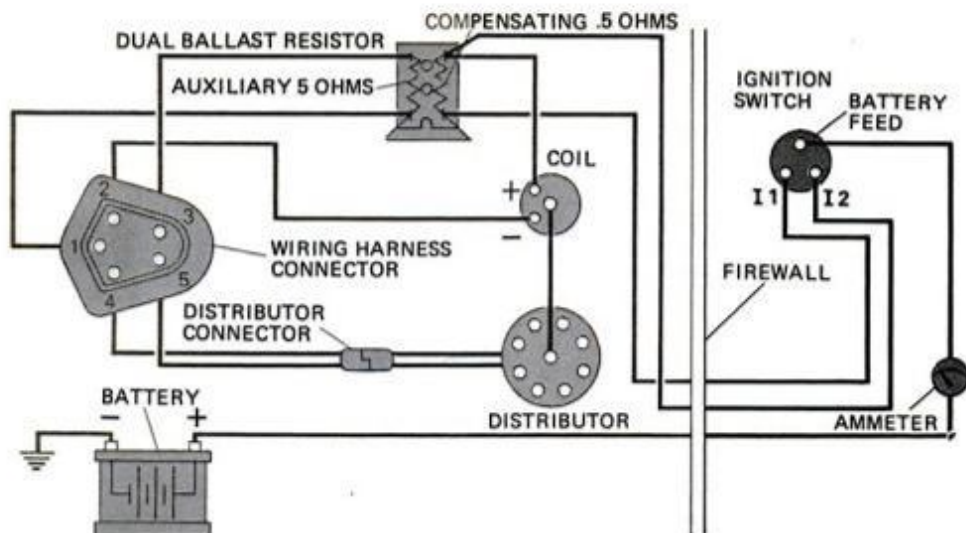
by Mort Schultz

It is time to take a hard look at original-equipment electronic ignition systems. Although they have been with us for several years, they remain a mystery to most.

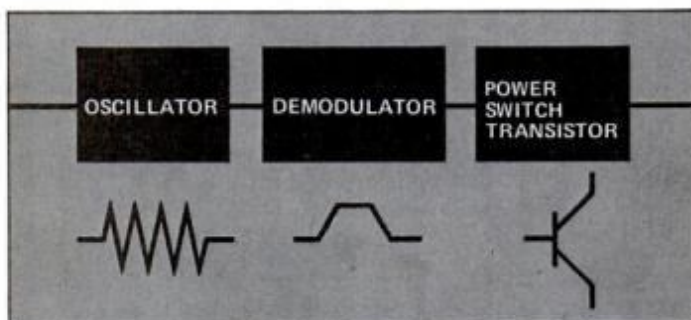
The electronic principles involved are pretty much the same from one

system to another. However, each system has its own unique design and requires special tests to diagnose problems.

There are five different electronic ignitions employed by American manufacturers on most cars and many trucks. They are the American Motors' Breakerless Inductive Discharge (BID) ignition system;



Chrysler system schematic diagram which you'll need to make test connections with voltmeter and ohmmeter. Troubleshooting test procedure is outlined in text.



AMC's breakerless inductive discharge system (BID) uses an electronic control unit containing the circuit block diagrammed at left. Action of power switch transistor cuts off coil primary circuit so that high voltage is induced in secondary to fire plugs.

Chrysler Corporation's electronic ignition system; Ford Motor Company's Solid State (S/S) ignition system; General Motors' High Energy Ignition (HEI) system; and International Harvester's electronic ignition system.

The remainder of this article deals with the electronic ignition systems employed by Chrysler Corp. and American Motors.

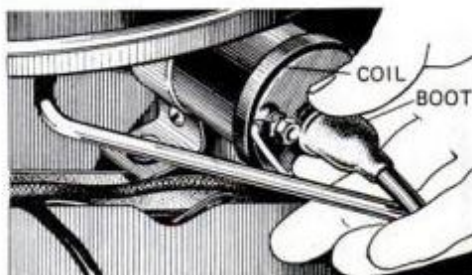
Chrysler: How it works

To put the Chrysler system into perspective, consider that it has a primary, a secondary and three additional circuits.

The primary circuit consists of a battery, ignition-switch side of a ballast resistor, primary windings of the ignition coil, power switching transistor (in the electronic control unit) and the car's frame.

The secondary circuit consists of the secondary windings of the ignition coil, distributor cap and rotor, sparkplug cables, sparkplugs and the car's frame. The three additional circuits are the auxiliary ballast resistor, electronic control unit feed and pickup.

The auxiliary ballast resistor and ignition-switch side of the ballast resistor are housed in one unit called the dual ballast resistor. The auxiliary resistor section is used to operate the circuitry of the electronic



Coil-to-distributor cable is too frequently overlooked when checking out a starting problem. Make sure it's making contact.

control unit. The normal resistor section helps maintain constant primary current with respect to engine speed.

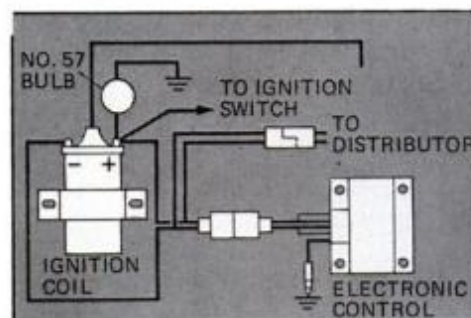
During engine starting, this resistor is bypassed so that the full battery voltage will be applied to the ignition coil.

The electronic control unit feed works hand-in-hand with the auxiliary ballast resistor to operate the electronic control unit circuitry. The pickup circuit senses the proper timing for the power switching transistor.

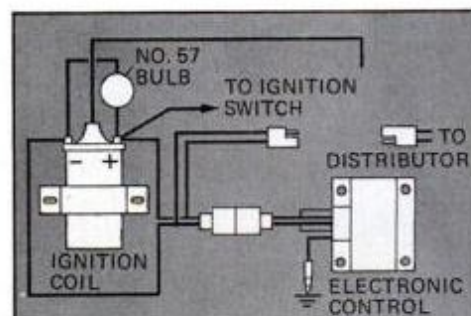
In operation, a reluctor rotating with the distributor shaft produces a voltage pulse in the distributor's magnetic pickup coil assembly. This pulse is transmitted to the power switching transistor in the electronic control unit, thus allowing the transistor to interrupt the current flow through the primary circuit. This break in the primary current induces



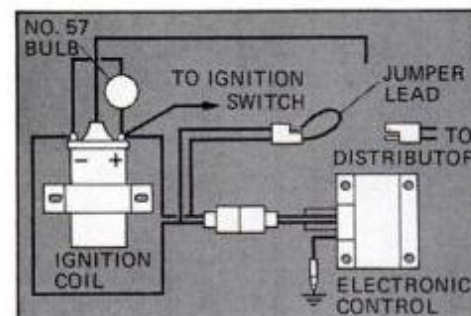
Air gap between reluctor and coil corresponds to point gap in conventional ignition.



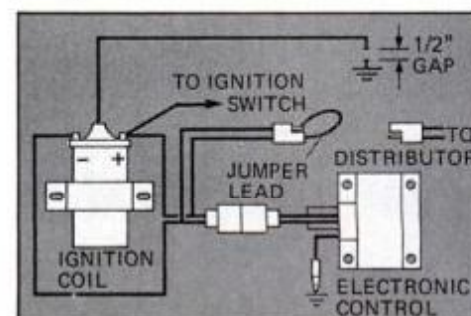
BID system: connections for Test No. 1



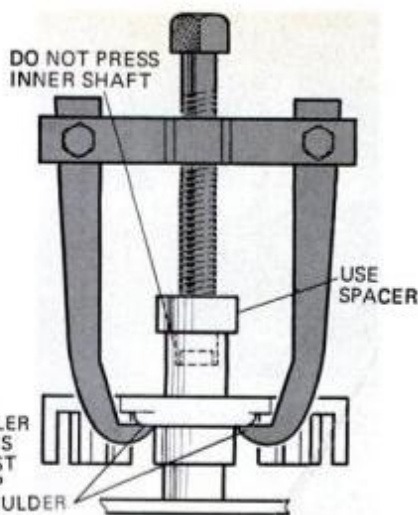
BID system: connections for Test No. 2.



BID system: connections for Test No. 3.



BID system: connections for Test No. 4.

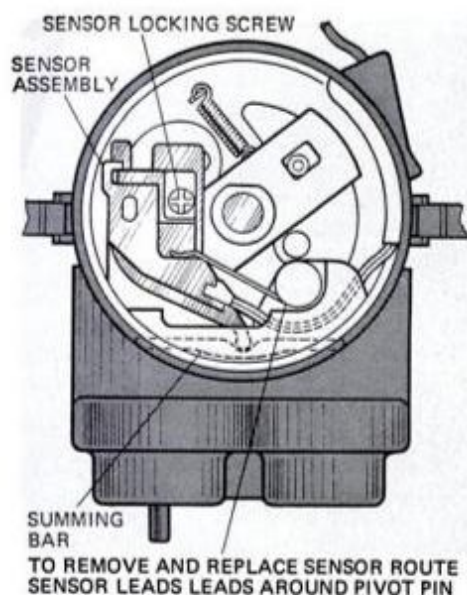


Removing the trigger wheel of BID system requires care as pointed out above.

the high voltage in the secondary circuit.

Caution: Do not touch the power switching transistor while the car's ignition switch is on. You will get a shock.

The circuitry in the electronic control unit determines the length of time that the power switching transistor maintains the flow of current in the primary circuit. This determines dwell, which cannot be adjust-



Removing and installing sensor assembly requires lead routing as shown above.

ed. Dwell affects ignition timing. Once basic ignition timing is set, further checks become unnecessary.

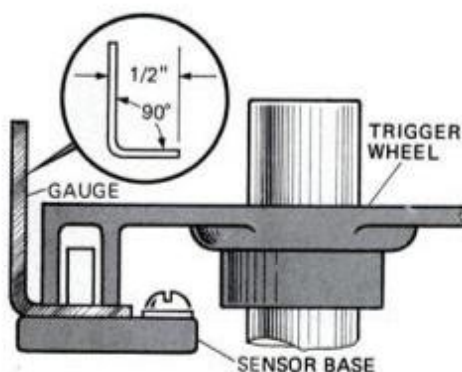
Chrysler: Finding the trouble

The troubleshooting procedure is clear. When a problem that you think is ignition-caused occurs, start by visually inspecting secondary cables for defects, and the primary wire at the ignition coil and ballast resistor for tightness.

At this point, you have a choice. You can buy Chrysler's Electronic Ignition Tester (C-4166-A), or use a voltmeter rated at 20,000 volts, and an ohmmeter that employs a 1½-volt battery. Since the Chrysler tester comes with instructions, let's outline the other test procedure.

1. Turn off all accessories.
2. Check battery voltage first. It should be a minimum of 12 volts.
3. With the ignition switch off, remove the multiwiring connector from the electronic control unit. Turn the ignition switch to ON. Connect the negative lead of the voltmeter to a clean ground. Connect the positive lead of the voltmeter to the wiring harness connector at the No. 1 cavity.

The voltage reading should be



A 0.050-in. wire gauge is used to set the distance between trigger wheel, sensor.

within one volt of battery voltage.

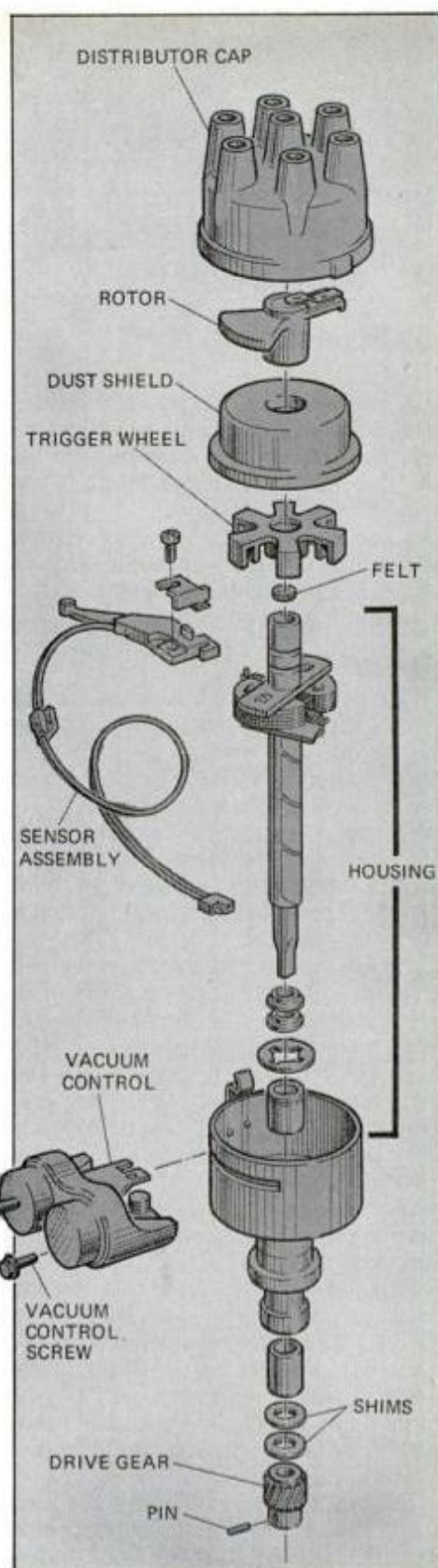
Check No. 2 and No. 3 cavities of the wiring harness connector in the same way.

If there is more than a one volt difference in any reading, check the circuit corresponding to the particular wiring harness cavity for cleanliness and tightness.

4. Turn off the ignition. Connect an ohmmeter to wiring harness connector cavities No. 4 and No. 5. This tests the distributor pickup coil. Ohmmeter resistance should be between 150 and 900 ohms.

If the reading is higher or lower, disconnect the dual-lead connector coming off the distributor. Connect your ohmmeter to this connector. The reading should be 150-900 ohms. If it isn't, replace the pickup coil in the distributor. If the reading is 150-900 ohms, reconnect the dual-lead connector. tightly. A loose connection is the probable cause of the erroneous ohmmeter reading to begin with.

5. One other test should be made to verify the condition of the pickup coil. Connect one ohmmeter lead to a clean ground. Connect the other to the connector of the distributor. The



AMC BID system distributor is exploded above. Trigger wheel and sensor assembly are the heart of system's operation.

ohmmeter should register an open circuit. If meter doesn't show a reading, replace pickup coil.

6. Continue testing by connecting one ohmmeter lead to a clean ground. Connect the other lead to the electronic control unit pin at cavity No. 5 of the wiring harness connector.

(please turn to page 216)

Bargain rigs are around—
if you know what to
look for, and where.

by Ross Olney

A second-hand recreational vehicle can be an economical magic carpet to camping fun. But only if:

- You know what you want before you shop seriously.
- You know where to look for problems in a vehicle you're considering.
- You know which problems can be overcome at what cost.

The right rig

In deciding what kind of vehicle you want, simply wandering from lot to lot or from private owner to private owner seldom gives you the answer. You first need to figure if you will be doing more traveling than camping or vice versa. How large a family or group will be along? What convenience features are important to you.

There are three major categories from which to choose—trailers, pickup campers and motor homes—and a number of sub-categories of each. Generally speaking, trailers are reasonable in price, easier to tow than you'd ever believe until you try, and can be left at a campsite while you go sightseeing or shopping. But they must be hitched, unhitched and parked, and you cannot ride in them in most states.

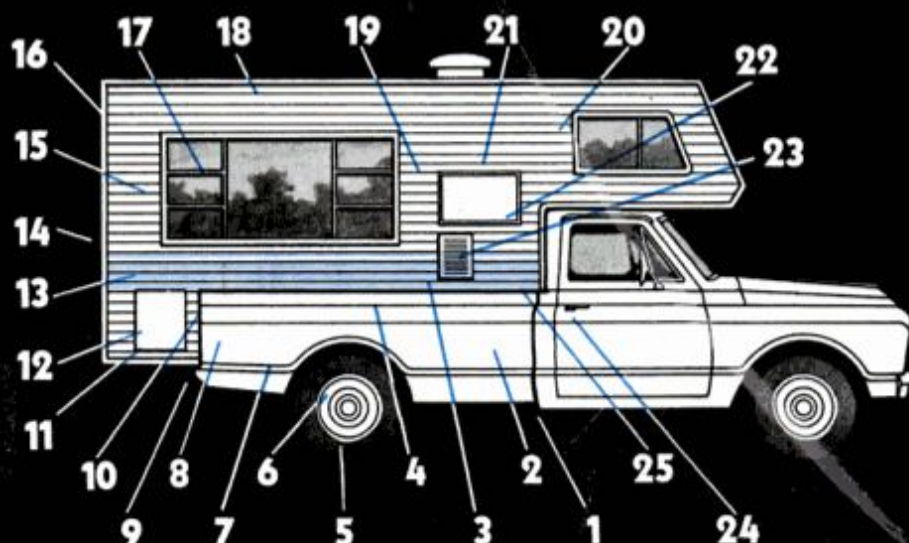
Pickup campers are also reasonably priced, if you already have the truck. They are convenient to use and can be left at a campsite, although they usually are not. If your truck can handle rough back roads, it's usually no problem to carry your slide-in camper along.

Motor homes are usually the most expensive and therefore the most luxurious. They must be driven away from your campsite and into town if you need a loaf of bread (which may be why many are seen towing compact cars today). The popular smaller minimotor homes and van conversions are probably better for traveling than for long stretches of living at one campsite.

The right condition

Select the type of rig that's best for you, but beware of "off-brands" and orphan makes that are no longer manufactured.

25 checks for



Y—Yes, buy vehicle if price is right. These items can be repaired inexpensively.

M—Maybe yes, maybe no, depending on whether price can be adjusted to cover the cost of repair.

N—No, don't buy it even if they want to adjust price. You can expect problems.

- | | |
|---|---|
| 1- N Inspect frame for bends, cracks? | 14- M Door(s) for solid closure and proper seating? |
| 2- M Water line leaks? | 15- M Toilet operation? Leaks? |
| 3- M Gas line leaks? | 16- Y Operation of all exterior lights? |
| 4- M Does the refrigerator work on all power sources? | 17- Y All windows for operation and seal? |
| 5- M Inspect tires and wheels? | 18- M Does the roof leak? |
| 6- M Brake operation and adjustment? | 19- M Cracked panels inside? |
| 7- M Does the holding tank leak? | 20- Y General cleanliness? |
| 8- M Auxiliary motor operation? | 21- N Does the interior arrangement suit you? |
| 9- Y Skids? | 22- M Water heater operation, gas and water leaks? |
| 10- M Operation of range, including thermostat in oven? | 23- M Operation of interior heater, including thermostat? |
| 11- Y Propane tank changeover valve? | 24- Y Tools, front jack on trailer? |
| 12- M Propane bottles for leaks and too much rust? | 25- Y All interior lights and electric plugs? |
| 13- M Operation of water system pressure pump? | |

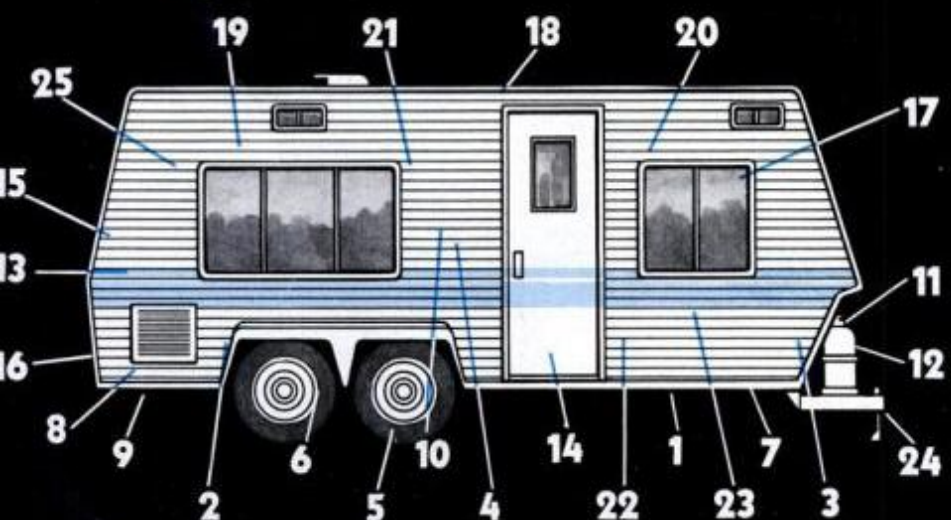
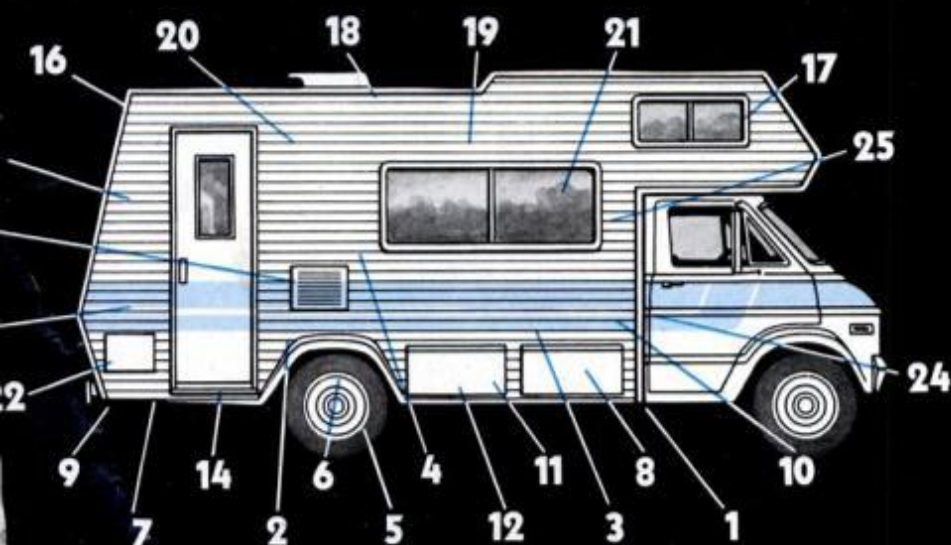
Look over a used unit very carefully. You can never fully straighten out all the problems in a badly misused rig.

First examine the outside closely. Look at the frame underneath for bends, welds or too much rust or corrosion. The body should be free of rust; any dings and dents should be small. Panels should not be missing. Signs that the rig has once been wrecked are a good reason to look elsewhere; there may be unseen and irreparable structural weaknesses.

And never settle, of course, for an exterior look or interior layout that you basically do not like. The price may be good, but you are never likely to be happy with it.

Examine the inside for signs of wear and tear, worn upholstery, battered or missing wall panels, general cleanliness, missing equipment. Entry, cabinet and closet doors should open and close smoothly, closet corners and other out-of-sight places should be clean, drapes and other accessories (even if you plan to replace

a used RV



RV shopping. A look at other units, newspaper ads, and the *Kelley Blue Book* of used RV prices that your bank may have, will give you a basic idea of costs. Some rigs, however, will have many extras and accessories installed; take these into consideration when figuring a fair market price.

What you want to pay and what the dealer has in mind may differ considerably. Haggling may get you together. If not, walk on. The market offers many good used RVs today, but bear in mind that a pampered RV, like a luxury car, tends to hold its value well. If it's in good shape, you'll pay for it.

The right dealer

Some RV owners claim your choice of dealer may be as important as the rig you select. He should have a reputation for honesty and integrity, be known for standing behind the units he sells and the guarantees he gives. He should be able to give you the names of satisfied customers, and his lot should be clean and well maintained. A well established service department is a definite plus, as is a trailer or RV supply store that stocks the incidentals you may need.

Dealers who belong say you are safer dealing with a member of the Recreational Vehicle Dealers Assn., and it's true that such groups tend to police their members. The dealer and his salesmen should not be pushy or overbearing, should not try to talk you into something you don't want and can't afford, and should willingly answer your questions fully.

A dealer will normally offer a guarantee on a used RV, while a private party sale is usually "as is," though the price can be substantially lower when you purchase from a private owner. What this former owner is willing to repair or make concessions for in the price are matters for negotiation.

When you are about to hand your money or check to private owners and you note tears in their eyes, it's a good sign. An RV that has received tender loving care is practically a part of the family. **FM**

em) should be in reasonable condition. General cleanliness, according to the experts, is a good indication of previous love and care for the

the stove, heater, refrigerator, sink, lights. Check the water and any pressure system, fresh water tank. If it doesn't work, the dealer should fix it (though you will want this done, of course). A private owner who won't fix anything, or who won't let a repair shop and

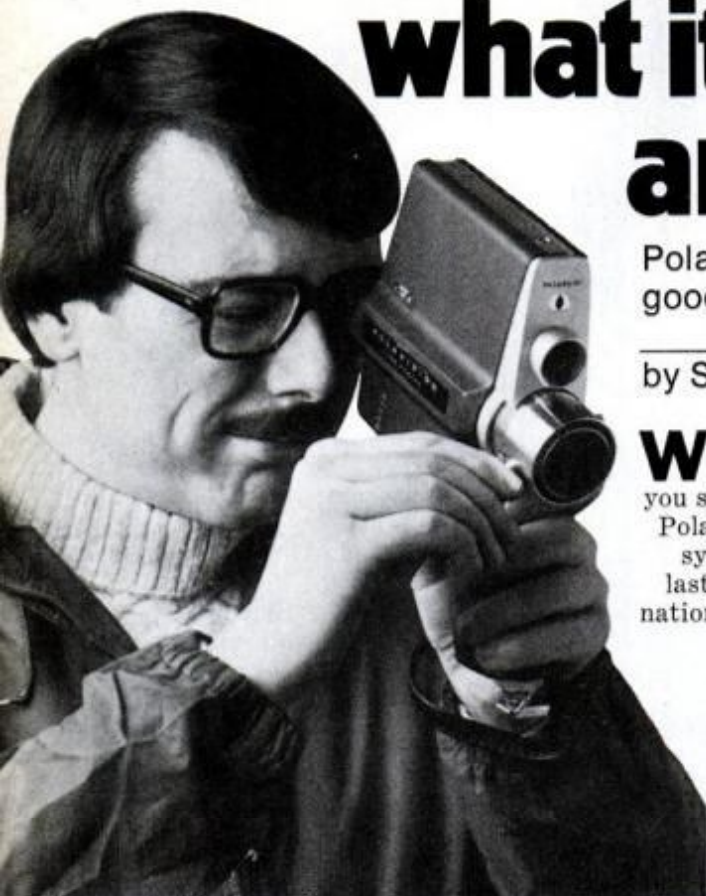
get an estimate. Then offer to deduct the amount of the estimate from the final sale price.

None of this should hurt the deal. Interior repairs, particularly for a dealer who has a repair shop, are generally inexpensive and quickly accomplished. Often it is just a matter of replacing an old part with a new one.

The right price

You should have an affordable ballpark figure in mind before you start

Movies in 90 seconds— what it's like to shoot and see them



Polaroid's movies are easy to make, provide good picture quality for can't-wait viewing.

by Stephen Walton

Want color movies you can see just 90 seconds after you shoot them? They're here. Polavision, the instant-movie system Polaroid announced last year, should be available nationwide when you read this or soon after.

I've been shooting Polavision and learning about its limitations and pleasures. If you expect the quality of 70-mm theatrical movies, it will disappoint you.

If you and your family get a thrill out of seeing a movie of what has just happened, it will delight you. There's really nothing to compare it to.

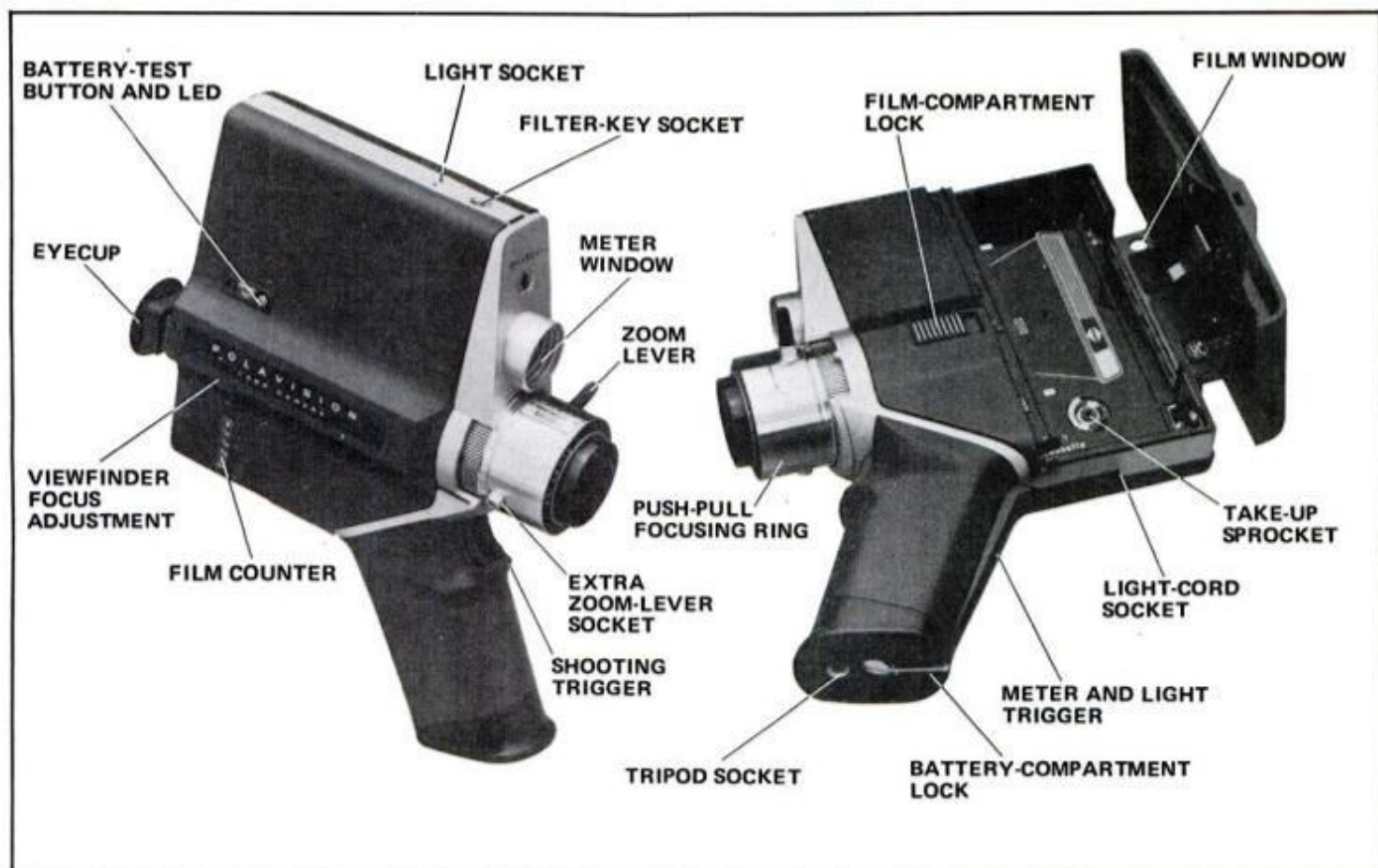
The system has three basic components: camera, film cassette and player-processor. The technology of the film and cassette is the major achievement, since development takes place entirely inside this 7/16 x 2 3/4 x 5 1/4-inch box (see *Instant Movies: Shoot Now, See Now*, page 94, Aug. '77 PM).

The camera weighs less than 2 pounds loaded, and is designed for

PM photos: Stephen Fay



Instant theater: Kids love to see themselves in action, and minute-and-a-half wait is no great trial.



Designed for virtually foolproof operation, camera is easy to handle even when you're wearing heavy gloves. Finder-focus adjustment let me shoot with or without eyeglasses. Control to compensate for backlighting or too much sky in scene would be welcome.

easy operation. The f1.8, 12.5-25-mm zoom lens has two focus ranges, 6 to 15 feet, and 15 feet to infinity. Exposure is fully automatic, with a hard-to-miss low-light indicator in the frame. There's a built-in color-correction filter for daylight shooting, locked out for indoor use with a screw-in key or by attaching the accessory Twi Light (twin quartz lights).

Snap in a cassette, close and latch the door, then run the camera—squeeze the rear trigger, then the front—until you see an LED flash above the finder frame. Now you're ready to shoot 2½ minutes of film. The LED will wink at you again when you're down to six seconds to

go, and will light steadily to signal the cassette's end.

Because exposure is fully automated, you should give some attention to your shooting situation. Outdoors, you'll get best results under classic snapshot conditions—sun at your back and on your subject. Avoid backlit situations unless you're deliberately silhouetting the subject. Indoors, take care not to exceed the Twi Light's 10-foot range; in very bright indoor environments, you can shoot without it, but make sure the meter is not reading a lamp instead of the subject.

Because there's no white flash between shots, animation becomes easy. Use a tripod, fire a burst of a few

frames, change the positions of the kids' toys, (for example, change or add to a title drawing) then fire another burst and so forth.

Polaroid suggests you plan your movies like a pro, and shoot for a beginning, middle and end in each one. You probably won't want to worry about structure until you've shot a lot of cassettes.

Pop the exposed cassette into the player and wait a minute and half, for processing and a "resting" period to let the film surface harden. Then the first showing begins. Second and subsequent plays start without the wait; rewind automatically follows each play.

The player has focus and framing controls, and the optional Instant Replay accessory lets you jump back within a cassette or to its beginning by remote control.

The final image shows some grain, and you can get very dark scenes in those tricky exposure situations. But color and contrast are good, and motion at 18 frames per second is acceptably smooth.

As a combination of portability and immediacy, Polavision is unique. You can film anywhere with it; you can film and play back anywhere there's a 110-volt outlet. It will be a good while before videotape can offer comparable convenience at a comparable price.

PM

Polavision system components and suggested list prices: camera, \$184; player, \$515; Twi Light, \$42; Instant Replay control for player, \$42. Cassettes are \$9.95 each. Also available is a \$26.95 carrying case that holds camera, light and four cassettes. Small black object is key that locks out daylight filter for indoor shooting without Twi Light.



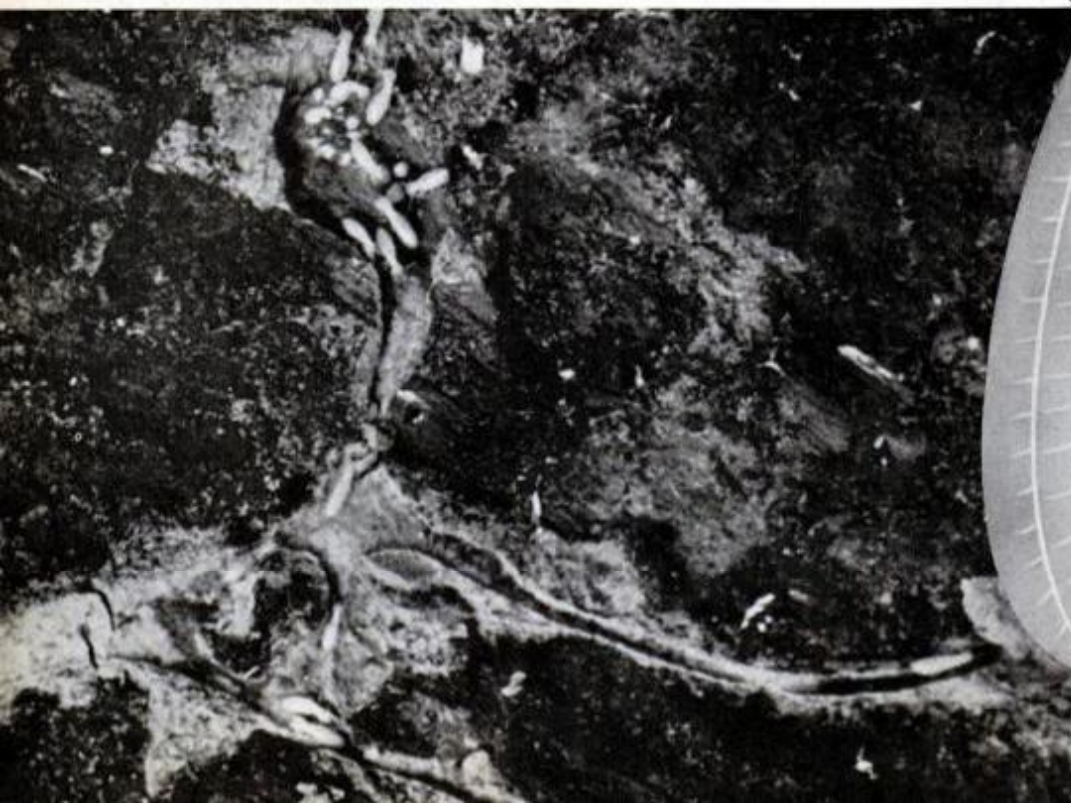
Don't feed your home to termites

by Ed Kerr



Termites with access to wood from soil unchecked, can do this kind of damage.

Termites at work—nibbling away in one of the galleries they create in wood.



What's the usual reaction when a homeowner discovers termites in his house? Sheer panic.

Actually the discovery of termites is *not* an occasion for panic because time is on the homeowner's side. Even a mature, well established colony of 60,000 workers eats only 1/5 ounce of wood a day. There's plenty of time to approach the problem rationally and get bids on a termite control job.

There's also plenty of termite control information available. In 30 years of research, the U.S. Forest Service has done everything to the termite but bug his phone. Researchers have identified chemicals that remain effective against termites after 28 years of service. They also know just about every avenue for termite entry into a house—and what roadblocks to use.

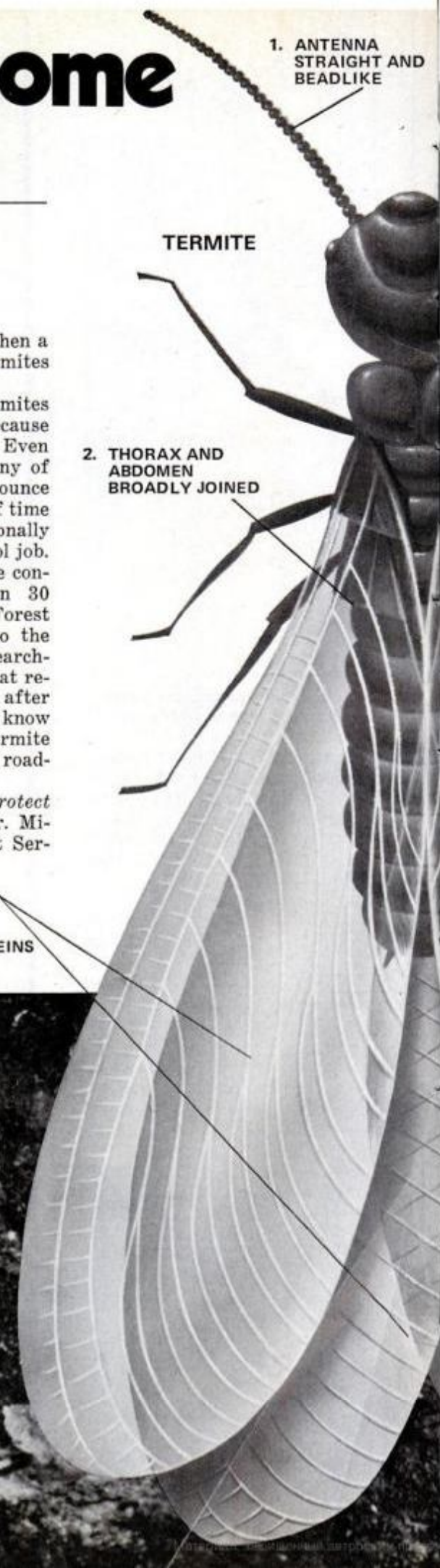
In his booklet, *You Can Protect Your Home from Termites*, Dr. Michael I. Haverty of the Forest Ser-

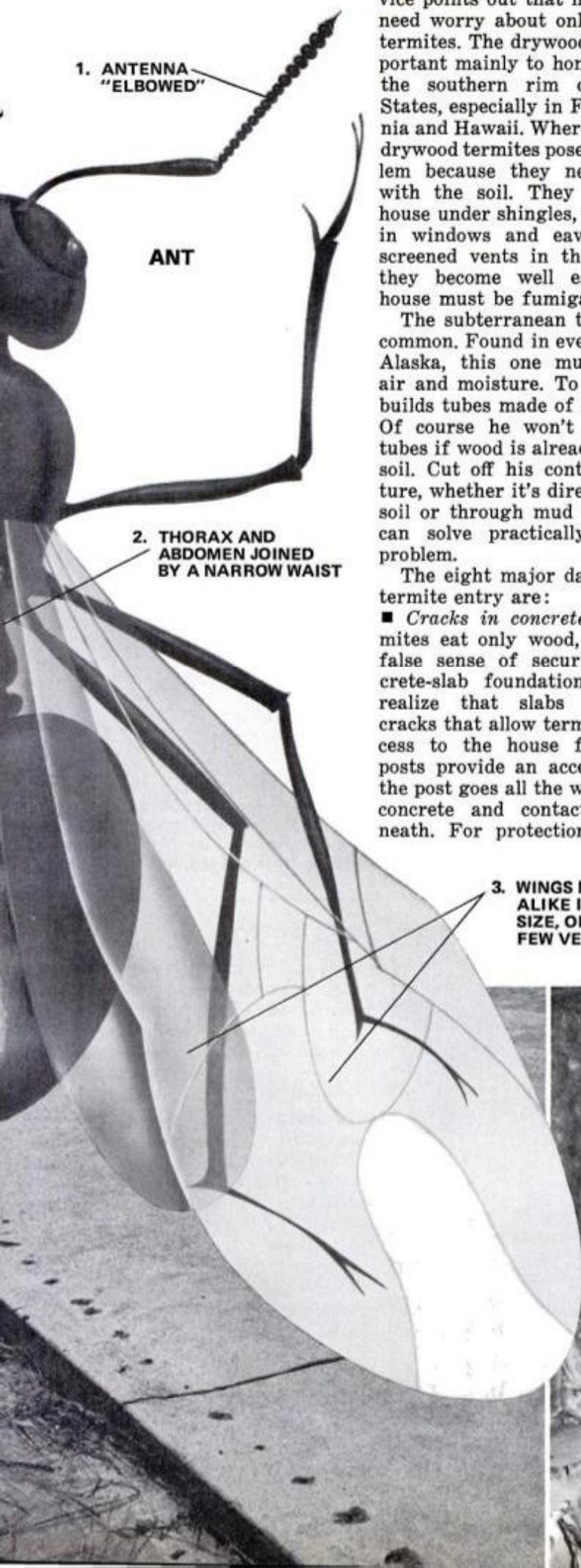
1. ANTENNA STRAIGHT AND BEADLIKE

TERMITE

2. THORAX AND ABDOMEN BROADLY JOINED

3. WINGS SIMILAR IN SHAPE, SIZE, AND PATTERN; MANY SMALL VEINS





vice points out that most Americans need worry about only two types of termites. The drywood termite is important mainly to homeowners along the southern rim of the United States, especially in Florida, California and Hawaii. Where they do occur, drywood termites pose a serious problem because they need no contact with the soil. They can enter the house under shingles, through cracks in windows and eaves or through screened vents in the attic, and if they become well established, the house must be fumigated.

The subterranean termite is more common. Found in every state except Alaska, this one must have warm air and moisture. To stay moist, he builds tubes made of soil as he goes. Of course he won't need to build tubes if wood is already touching the soil. Cut off his contact with moisture, whether it's direct contact with soil or through mud tubes, and you can solve practically any termite problem.

The eight major danger areas for termite entry are:

■ **Cracks in concrete.** Because termites eat only wood, people have a false sense of security about concrete-slab foundations. They don't realize that slabs often develop cracks that allow termites hidden access to the house framing. Wood posts provide an access route when the post goes all the way through the concrete and contacts soil underneath. For protection, the soil be-

neath slabs and footings should be treated with a termite insecticide.

■ **Earth fill under porches.** Here, again, concrete may give false security. If the concrete porch has earth fill underneath it, soil may be in contact with framing members. To be safe, make certain soil is at least 8 in. below the lowest wooden member.

■ **Buried wood.** Too often, wood scraps left over from construction are buried near the house or forms are left in place after pouring the foundation.

■ **Leaking pipes and faucets.** These can provide all the moisture needed for a thriving termite colony. The same holds true for gutter downspouts that fail to carry water away from the building.

■ **Poor ventilation.** When air doesn't circulate, moisture forms. This is a special hazard in crawlspaces, so adequate venting should be installed to assure good cross-ventilation. Be sure that shrubbery doesn't block vent openings.

■ **Flower planters.** Planters built near the house should be waterproofed below soil level. An air space between planter and house is an added safeguard.

■ **Porch steps.** If in contact with soil, wood porch steps offer termites their own stairway to your home. Steps should rest on a concrete apron and soil below should be protected.

■ **Wood trellises.** A common mis-

(Please turn to page 220)

Crack in concrete slab (below left) can give termites an entry into your house.

Scrap lumber in earth-floored basement (below) invites termite infestation.

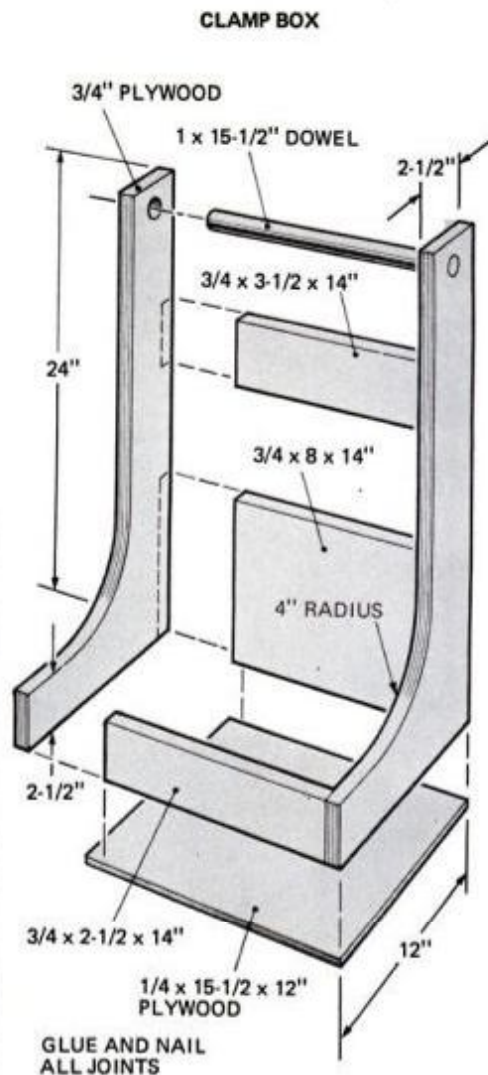
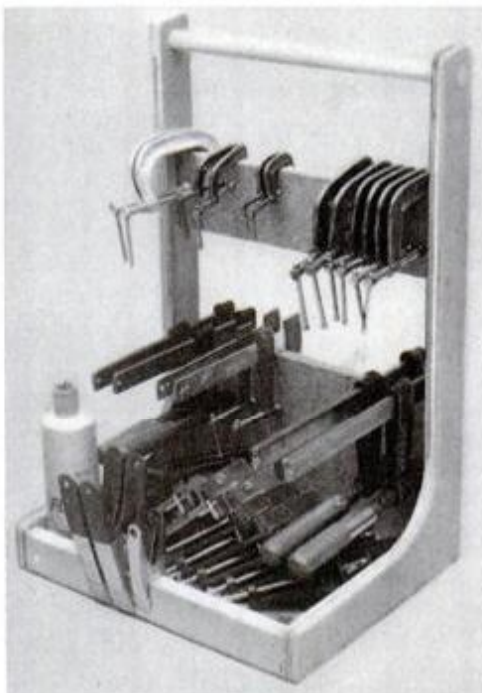


Two good projects for your workshop

SMALL CLAMPS RACK

A clamp rack built of scrap materials will untangle your collection of small clamps and allow you to select an appropriate one quickly while working. The rack is built with plywood sides, bottom and front. A 1-in. dowel is used for the handle and back pieces may be made of particleboard. Dimensions can be altered to suit, but remember that weight of more than a few dozen clamps may make the rack unwieldy.

To construct, use carpenter's glue and 1 1/4-in. ringed nails to help prevent joints from pulling apart. It's also good practice to predrill nail holes with a bit slightly smaller than the nail's diameter. This helps eliminate splitting. Slightly round all exposed edges with sandpaper. —Stephen Peterson



This easy-to-carry box holds glue, clamp pads and right-angle clamps in a tray. Other clamps may be clipped or hooked onto the front and the back pieces.



Plywood is fastened to inside faces of vise jaw with 1/4-20 machine bolts.



Front plate guides chisel, while back prevents chipping when paring off waste.

WISE ADVICE

Through-dovetails, finger joints and various halved joints require careful paring to avoid tearing shoulders and chipping the workpiece face. A simple plywood "sandwich" will make the paring away of waste from dovetail sockets and other against-the-grain trimming jobs much less awkward.

Cut out two identical rectangular plates from 3/4-in. plywood, sized to suit your joining needs. Center and drill holes in each piece about 2 in. from base. If you own a metal vise, drill and tap holes for bolting plywood to jaw faces. (Roundhead wood screws and washers may be used for mounting on wooden vises.) Countersink for bolt or screwheads and washers. Don't tighten them too much or they will be hard to pivot into other positions for reaching difficult angles or for swinging them out of the way. Replace pieces when they are gouged and worn. —Andrew Koopman

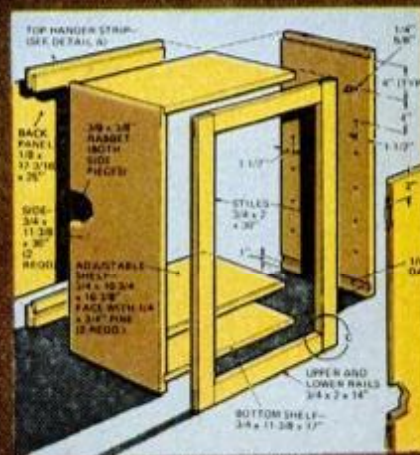
DOING-IT-YOURSELF
is still the least expensive
way to remodel—if you're
armed with solid know-
how. On these pages we
show you how to:

- Plan your new kitchen
- Choose bath products
- Reroof your house
- Replace a front door
- Seal leaky gutters
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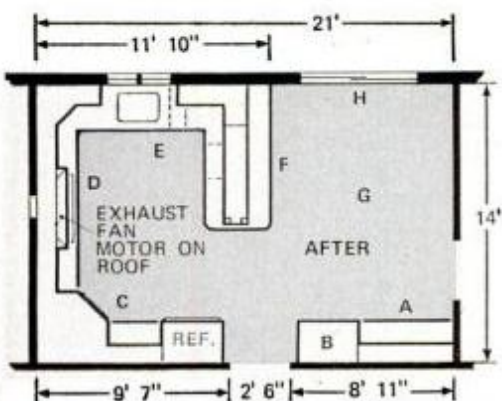


Counter is laid out to provide efficient "U" shape at window end; sink is below, countertop range at left. See floor plan (below) for refrigerator location.

A GREAT KITCHEN— BY DESIGN

A well designed kitchen enhances family lifestyle. Here are the basics to consider when planning your kitchen.

By Harry Wicks HOME AND SHOP EDITOR



There's lots of efficiency in PM's kitchen. A: Home office planning center with intercom. B: Multistorage pantry unit. C: Food center unit, wall oven. D: Food preparation, countertop range, microwave oven. E: Sink, dishwasher. F: Peninsula snack counter. G: Dining area. H: Sliding (bypassing) doors. Refrigerator/freezer is next to the counter with built-in food center. Work centers were laid out to create an efficient work triangle (see text).

For a number of reasons, you may be thinking that now is the time to remodel or update your kitchen. Perhaps your kitchen is too small with inadequate storage space—and you like the idea of knocking out a wall so you can add on and create a larger kitchen. Or maybe your existing kitchen is just plain drab and dull and you're bored with its looks. Or the cabinets and appliances have had it. They're worn out and you are ready to move up to a better kitchen with quality component parts.

Because a kitchen (like the bath-

room) is, in effect, furnished once the installation is complete, it is one of the most expensive rooms in your house (on a square foot basis). Besides its built-in furnishings, a kitchen also requires a heavy investment in plumbing, heating and electrical work. In many cases, a kitchen updating may consist of nothing more than painting, wallpapering, changing the floorcovering or installing several new light fixtures—which can be done for a couple hundred dollars or less. A full remodeling—new cabinets, appliances and such—can run anywhere from \$3000



Peninsula snack counter (center) creates a look-through entryway when viewed from bypassing doors to the right. Antique-glass door inserts above add touch of color.



up depending upon kitchen size, number and quality of cabinets and appliances.

Over the long haul, you are well advised to consider installing better quality cabinets; they'll probably be in use from 15 to 20 years. We selected from the Quaker Maid Company's Fireside cabinet line with Woodstream finish. As do all quality manufacturers, Quaker Maid has a



Before: The old kitchen (above left) featured poor-quality cabinets with ill-fitting doors and drawers, unimaginative design and lack of storage space.

Tired-looking corner in dining area had a lone cabinet next to an inefficient closet. Both were replaced by the grouping shown at right—a pleasant home-office planning center next to the good-sized multistorage section. See photo at the top of page 136 for view of pantry.





Peninsula unit increases the kitchen's storage capacity and its stepdown top provides a handy eat-in counter for quick breakfasts, lunches and snacks. Hangers overhead are fitted with doors on both sides to create easy dish and plate storage (from dishwasher) on kitchen side, and equally convenient removal for setting table in dining area. Accent wall in dining area, below, is by Z-brick.



Tappan wall oven is built into luxurious-looking corner cabinet with a 45° front. Versatile Food Center by Nutone is set in the counter to oven's left.

large variety of cabinets, finishes and hardware to choose from.

Do-it-yourself? Professional job? Or both?

Once you have decided you want a new kitchen, itemize all important ideas and some information. Write your ideas down and if you plan to do the job yourself, make a 1/2-in. scale drawing of your kitchen, showing all windows and doors. Then take your drawing and information to a kitchen specialist. Despite added costs, even avid do-it-yourselfers often prefer a professional's help here. The alternative, usually, is to

tie up this important room for an unbearably long time. You should know that a reliable kitchen contractor can usually complete an extensive installation in two weeks or less. A do-it-yourselfer, on the other hand, can (and often will) stretch the job out for six months.

Over the long run, a professional can save you money and time because he will relieve you of the countless details involved in design and planning. And you won't have to research construction specifications or spend hours coordinating delivery of materials and plumbers, carpenters and other trades.

Keep in mind that mistakes made in kitchen planning are generally costly. If you make one you will have to live with the loss. The pro has to deliver what was agreed to.



Multistorage cabinet (far left) uses all space for storage. Quaker Maid's units have durable hardware and hinges for troublefree handling. For more food storage, a number of swing-out units were built in base cabinets (left). Fluorescent light under the peninsula hanger (below) illuminates snack bar.



Nutone's in-counter food center uses one power unit to operate eight separate appliances—mixer, blender, meat grinder, shredder-slicer, can opener, ice crusher, knife sharpener and fruit juicer.

If you plan to be your own contractor, take every opportunity to obtain helpful information from specialized commercial sources. Usually for no extra charge, the guy who sells you your cabinets will work up plans with you, make suggestions and explain building codes to help insure your success.

Where to start

For openers, always remember that a kitchen is really a work and storage center. If you have the space, it may also serve as a sometime eating centers as ours does. So the first step is to determine just what you want to do in the kitchen. Do you spend long hours in your kitchen creating gourmet meals? Baking? Preserving? Or do you store lots of ready-to-cook foods?

Once you have analyzed just how your kitchen will be used, go to work laying out the three basic work centers—food and utensil storage, preparation and cleanup. Connect these three centers on your floor plan and you will have the basic work triangle—the path someone will most often follow when occupied in the kitchen.



For efficiency and comfort, the sum of the three legs of this triangle should not be less than 12 ft. or more than 22 ft. If possible, also lay out the work triangle to avoid cross-traffic interference with the cook.

Other important points to check:

- Place the dishwasher next to the sink to save steps.

- If you're not putting in a dishwasher right now, install a 24-in. cabinet next to the sink. It will be easy to install a dishwasher later, if desired. If kitchen will lack a dishwasher, install a double-bowl sink.

- Make certain that you have at least 24 in. of counter space to the right of the sink and at least 18 in. to its left for stacking dishes.

- You need at least 36 in. of countertop on the door-opening side of the refrigerator for parking groceries just toted in.

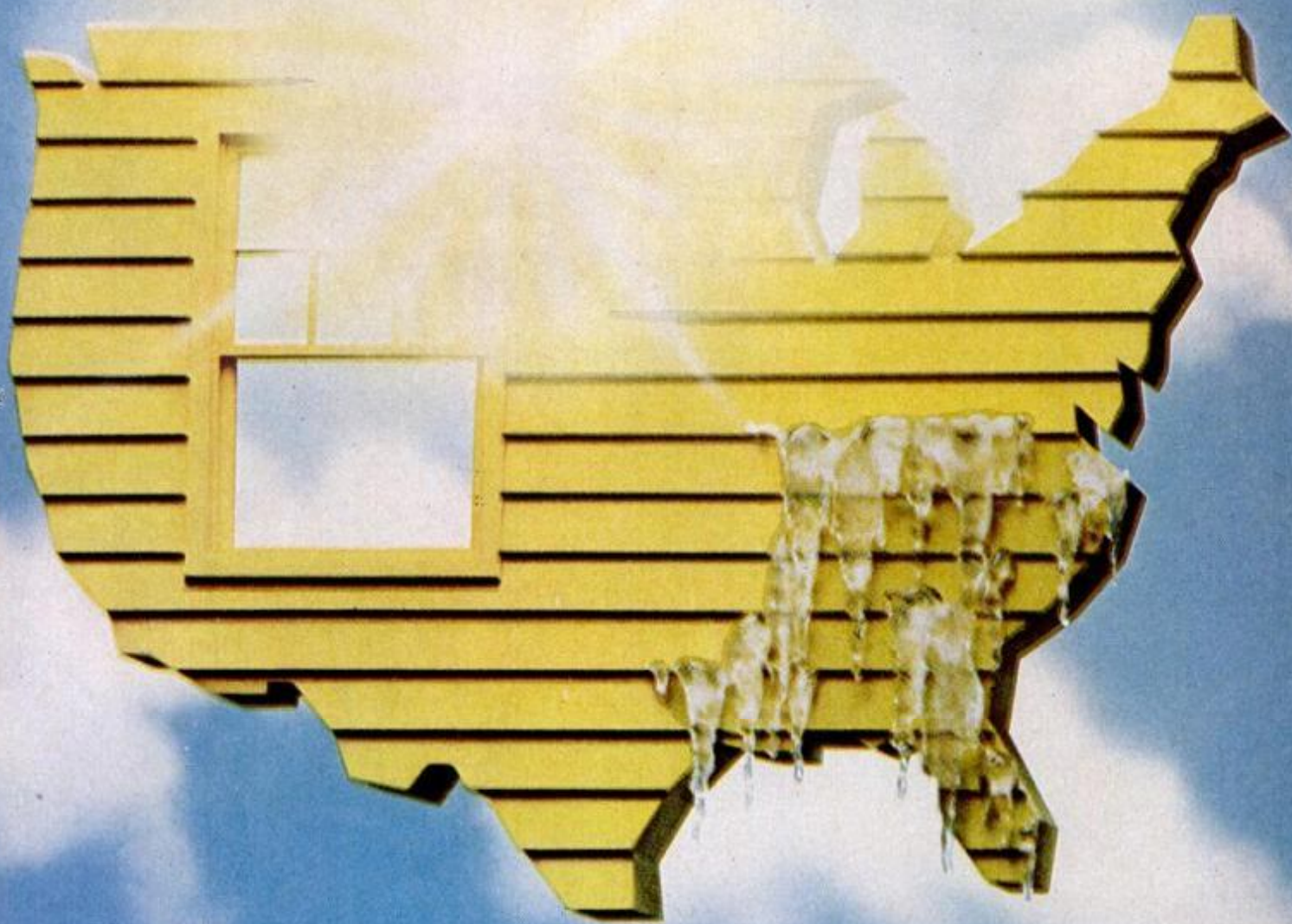
- For safety, have 18 in. of space on both sides of a countertop range.

For additional kitchen planning help, write Quaker Maid and ask for the "Cabinet Specification and Accessory Guide"; it's \$1 postpaid. See box below for the address. **PM**

CREDITS, SHOPPING INFORMATION

All materials used in the PM kitchen are available throughout the United States. For buying information or nearest dealer, write direct to manufacturers.

Kitchen design adviser, Hector J. Beaudoin; PM color photos by Harry Hartman; stylist, Emy Leaser; cabinets, beams and trim, Quaker Maid, Route 61, Leesport, Pa. 19533; appliances, Tappan, Tappan Park, Mansfield, Ohio 44901; roof exhaust fan, radio intercom and Food Center, Nutone Housing Products, Madison and Red Bank Rds., Cincinnati, Ohio 45227; Country Rustic brick wall covering, Z-brick, Woodinville, Wash. 98072; Aquarian sink trim by American-Standard; Undercabinet lighting, Sterling Div., Scovill, 5691 Rising Sun Ave., Philadelphia, Pa. 19120; Waterbury chandeliers, decorative lighting, Lightcraft of California, 1600 West Saluson Ave., Los Angeles, Calif. 90047; No-seam flooring, Solarian, Armstrong Cork Co., Lancaster, Pa. 17604; table setting, Corning Cookmates Cookware Wedgewood oven-to-table ware, dining table; white chairs and counter stools, The Workbench, New York, N.Y.



The house paint that weathers the changing weather.

If you think all these drastic and unexpected changes in the weather have been tough on you, think of the beating they've given your house.

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You can build this add-on solar room

This practical one-room addition will actually heat part of the house it's attached to.



Sensor (top) is wired to thermostat; fan blows warm air into the house.



Solar heat is stored in four 55-gal., water-filled, black-painted drums aligned along the north wall.

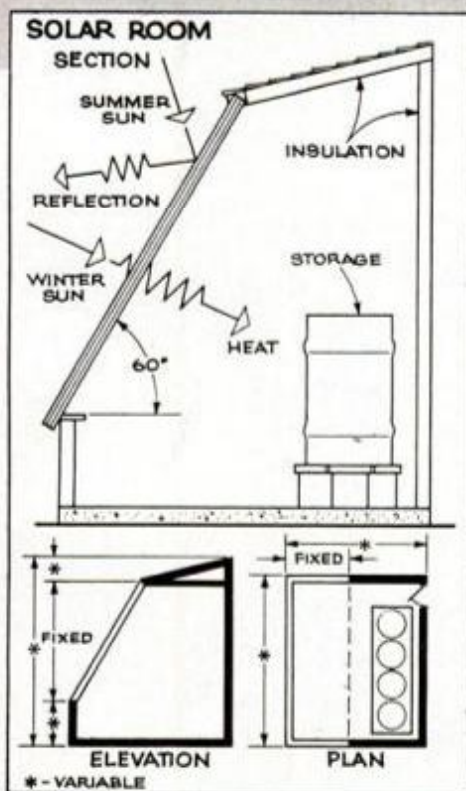


Thermal drapes by ATC, Brattleboro, Vt., minimize night heat loss.





The simple, clean lines of this add-on solar room make it compatible with most home designs—even this 19th century Vermont house.



The 60° slope of the window wall assures maximum solar transmission in the winter, minimum transmission in summer.

The solar room is a sunny addition that can be a family room, greenhouse or breakfast nook. It can be adapted to the southern wall of many existing homes to provide heat as well as extra space. The supplemental heat could reduce your fuel bill up to 40 percent, depending on climate.

No expensive solar hardware is needed. Materials cost of the room shown—developed by Parallax, Inc., Hinesburg, Vt.—is under \$900.

The room, plywood-sheathed and insulated with fiberglass batts, can be glazed with such materials as flat fiber-



East wall is glazed. Reinforced insulating Acrylic SDP by CY/RO Industries, Berdan Ave., Wayne, N.J. 07470 is suggested.



Solar room rests on concrete block piers placed on poured concrete footings (top). Above: Room is ready for siding.

glass, glass or polyethylene. You can finish the exterior to match your home.

Room heat controls include a differential thermostat and two small room-to-room fans. One fan blows warm air from the solar room to the house. The other blows cool house air to the room for heating. When the thermostat senses a significant difference between solar room and house temperatures, it activates the fans to transfer air.

If your house has warm-air heat, you can duct the solar room output directly into the cold-air return of the furnace and use the furnace blower to

circulate air throughout the house. This excess heat collects in water-filled drums for use when needed.

The room adds space, heat and value to your home.—Penelope Angell

HOW TO ORDER PLANS

To order plans for the Solar Room shown, send a check or money order for \$9.95 to Garden Way Publishing, Dept. 80194, Charlotte, Vt. 05445. Specify Solar Room Plans. Allow three to four weeks for delivery; for faster, first-class mail, add 75 cents. Plans include how-to-build and finishing information, drawings and materials list.

Note: If a building permit is required, order the two-plan set priced at \$15. You'll need a plans set to attach to your permit application.



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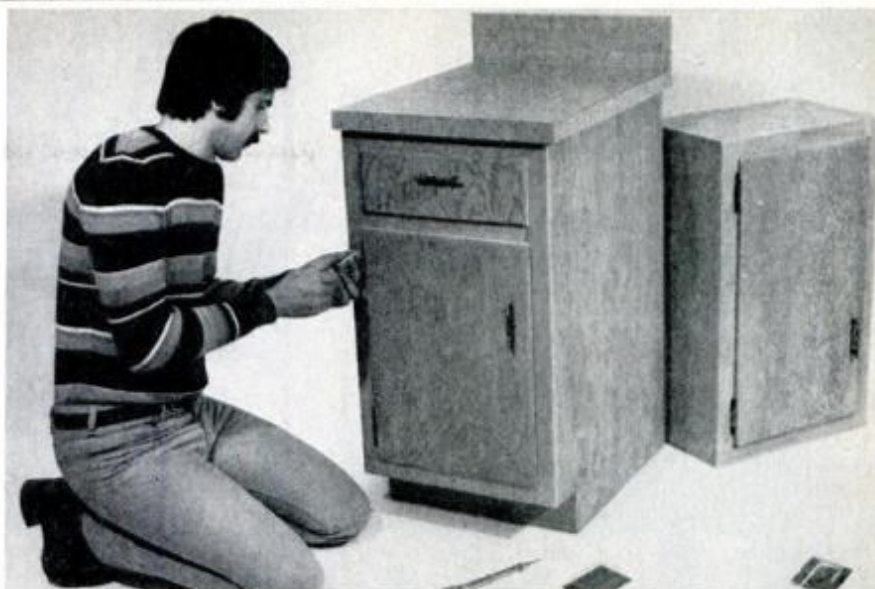


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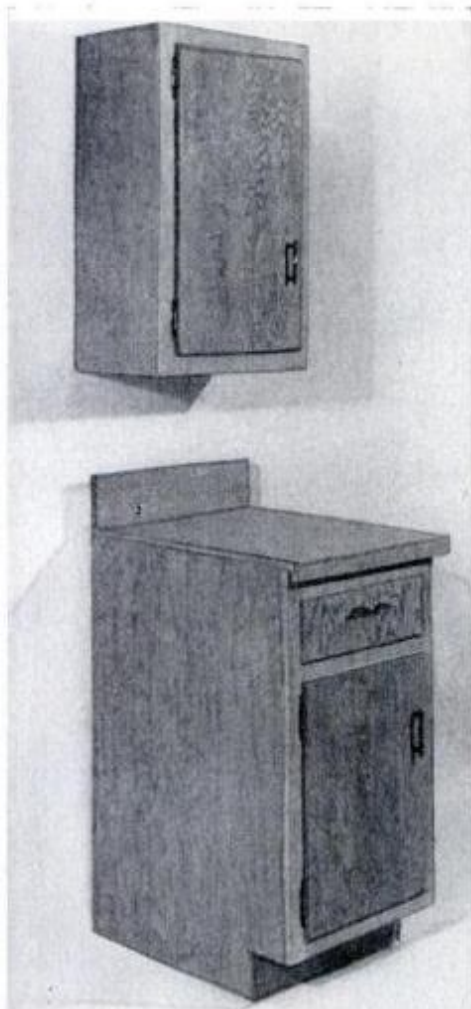
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How to build your own kitchen cabinets

It's a sure way to keep down home improvement costs.

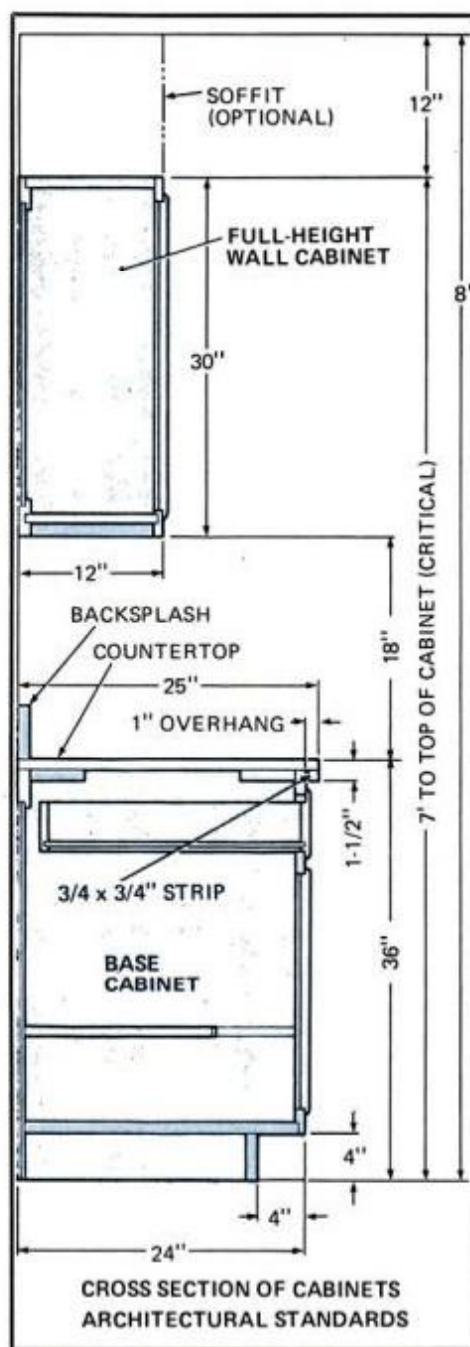


PM photos: Rosario Capolista



1 A typical base and wall cabinet construction with a Formica countertop.

The least expensive way to put new cabinets into your kitchen is to build them yourself. On these pages we give the basics for base and wall-hanger cabinet construction. If cost is of prime concern, build yours of fir plywood, then seal the wood with a pigmented shellac (such as B-I-N, or Enamelac) and finish it with a semi-gloss enamel.



2 Architectural standards should be used for maximum user comfort.



3 Base cabinet utilizes hardware that's available commercially. See plans.



4 Wall cabinet with adjustable shelves provides better storage efficiency.

If you prefer a more durable finish, consider covering all exposed surfaces with a high-pressure laminate such as Formica or Nevamar. Wood fanciers will opt to build cabinet fronts of hardwood (i.e., cherry, oak, maple) and doors and drawer fronts of matching veneer-grade plywood. These woods can then be stained and finished with

(Please turn to page 143)

It's built like circular saws used to be.

No skimping. No short cuts at the saw's expense. The way it used to be, when what mattered most was how good you could make it.

The Rockwell 4577 7 $\frac{1}{4}$ " Circular Saw. A 2-hp, 10-amp, home use saw with the guts to have a commercial duty rating.

Ball instead of sleeve bearings. Helical instead of spur gears, made of hardened steel instead of powdered metal. And a lead-pull instead of tang-wound armature, with welded in instead of soldered connections.

Now, if what all that means is a mystery to you, it's understandable. But put it all together and what it gets you is plain as day.

A saw with longer bearing life.

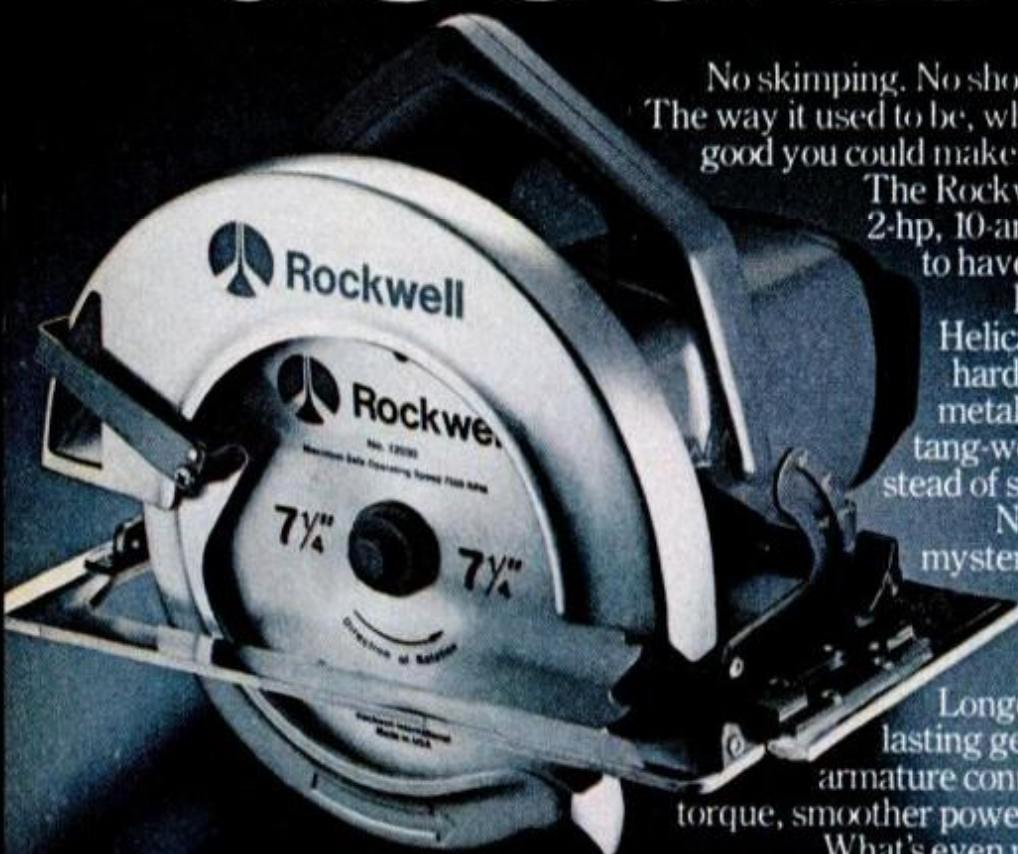
Longer brush life. Stronger, longer lasting gear teeth. Virtually unbreakable armature connections. And higher sustained torque, smoother power transmission, quieter running.

What's even more impressive, if that's possible, is what you can see yourself.

The aluminum baseplate, upper and lower bladeguards, and gear housing. Not to mention features like a $\frac{1}{4}$ " pretravel safety switch and the same sawdust-ejection chute on our best builder's saw.

All of which make it one heck of a value at just \$74.99*. The same kind of value we build into all our circular saws, from the least expensive on up.

Would you want it any other way?

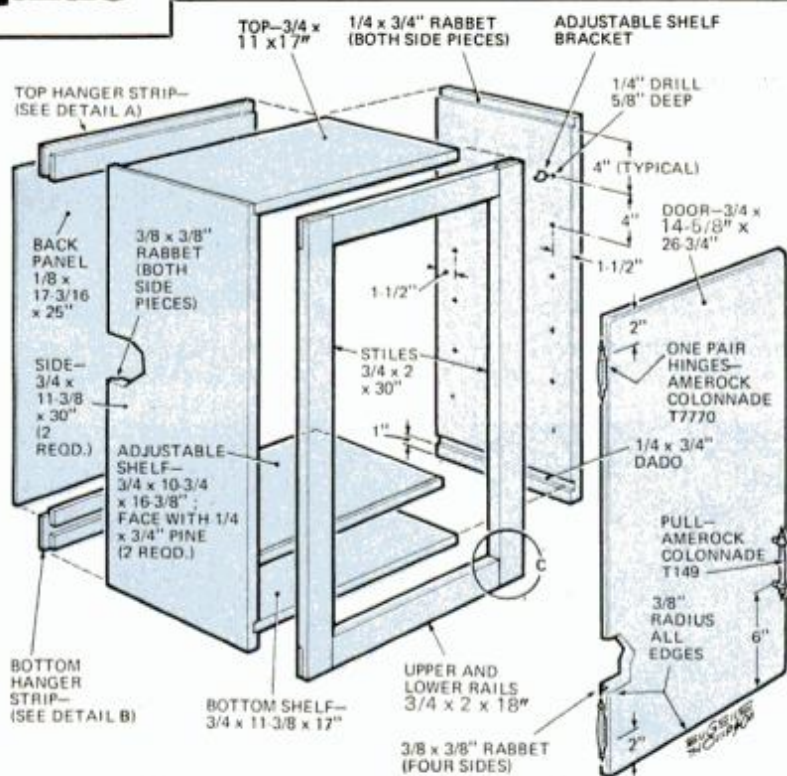


* Manufacturer's suggested retail price.

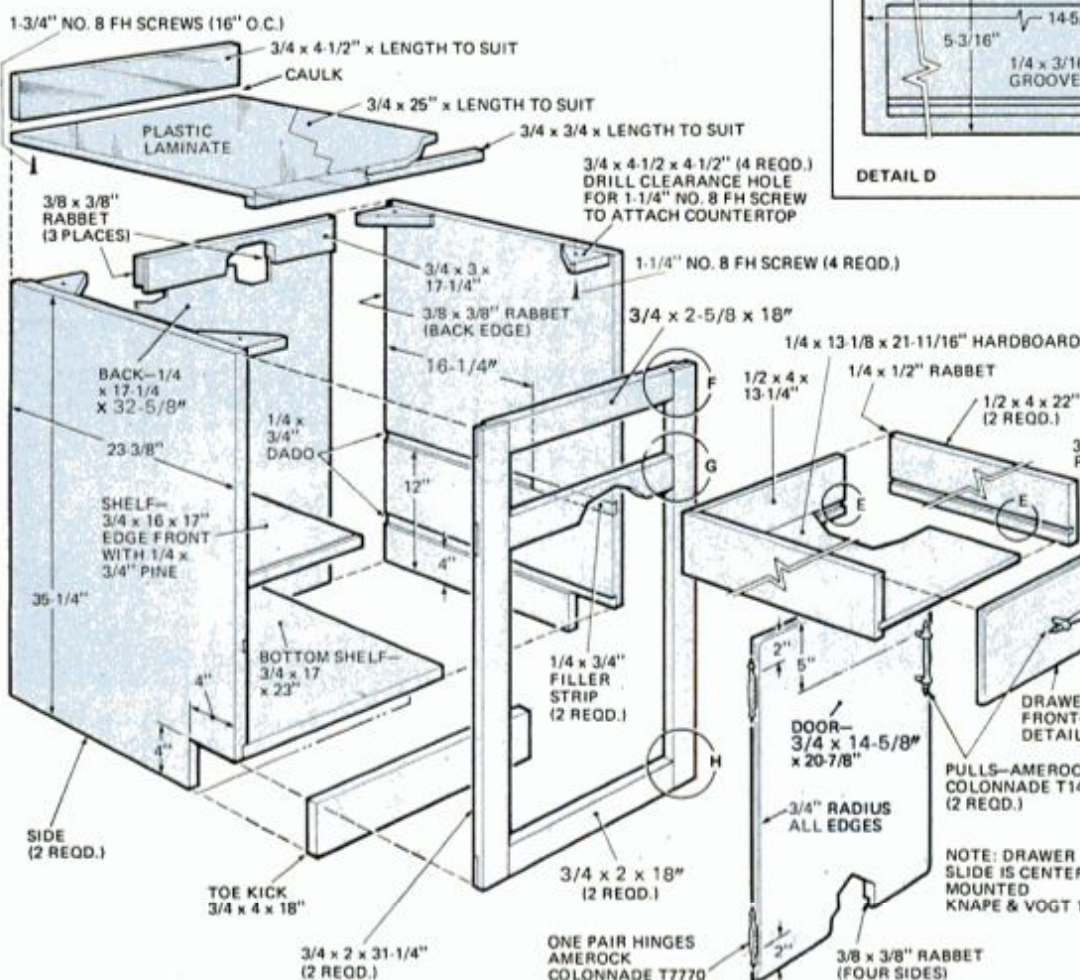
See the Yellow Pages under "Tools—Electric" for your nearest Rockwell dealer. Or write Power Tool Division, Rockwell International, 6263 Poplar Avenue, Memphis, Tenn. 38138



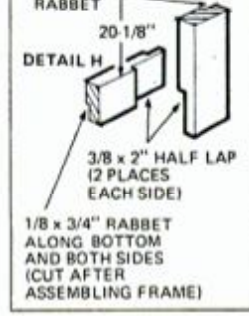
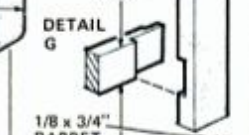
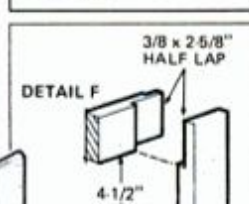
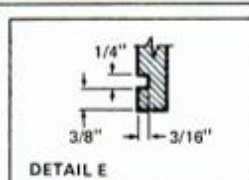
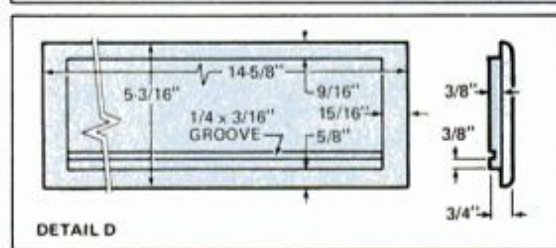
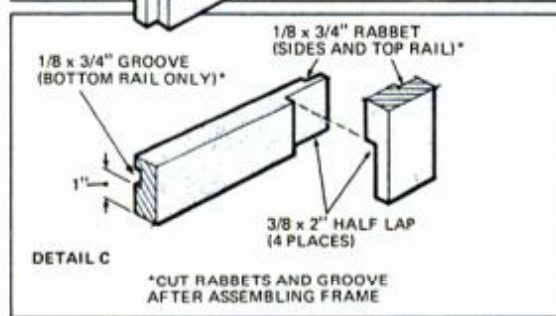
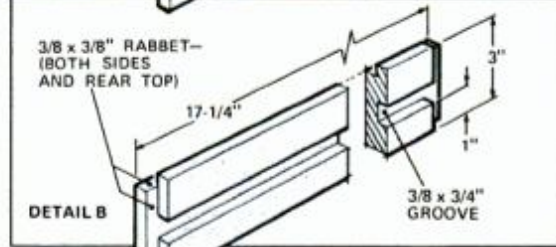
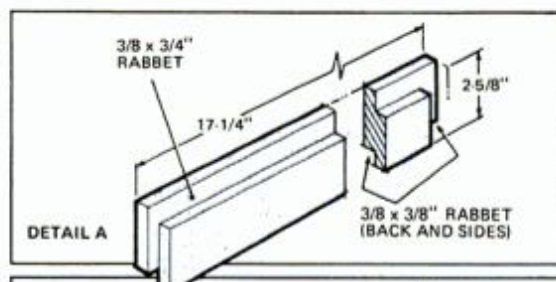
Rockwell International



TYPICAL WALL CABINET PLANS



TYPICAL BASE CABINET PLANS

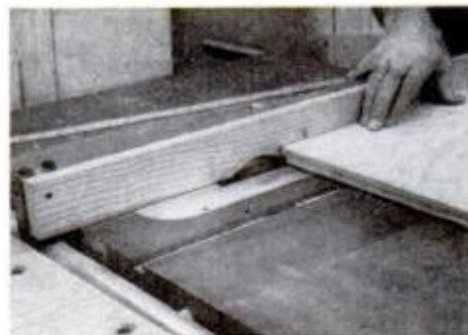




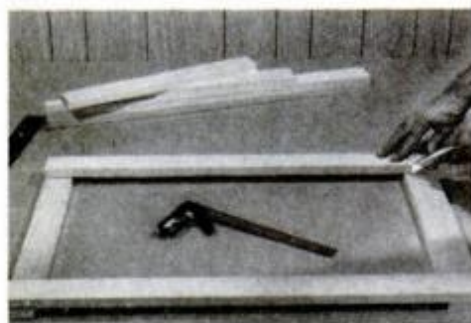
5 Mark plywood using a thick or double line to allow for width of saw kerf.



6 To set fence for cutting dados, mark location of test cut on the table.



7 Auxiliary wood fence attached to rip fence allows full-width rabbet cuts.



8 Use a razor knife to mark lap joints accurately on the framing members.



9 Cut laps on rails using miter gauge and dado head set for the widest cut.



10 Reassemble the cabinet-front frame face down for marking of stile laps.



11 When clamping glued frames, wax paper prevents the cauls from sticking.



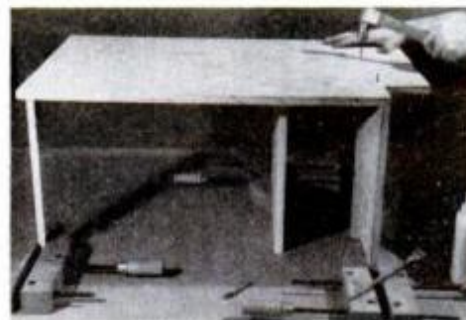
12 After removing glue squeeze-out, cut rabbets in stiles and bottom rail.



13 Test-fit shelf in sides, and add filler strips in front before assembly.



14 Base cabinet components, less drawer and door, ready to assemble.



15 Handscrew clamps hold base, shelf, temporary support-stick upright.



16 Set all nails and fill the holes with a wood plastic filler; then sand.

polyurethane varnish.

Begin the base cabinet by cutting the pieces according to plans. Vertically orient the grain pattern on all exposed surfaces. Cut large panels with a portable saw, guided by a clamped-on straightedge.

Dadoes and rabbets are quickly made on a table saw equipped with a dado head. Always check the depth

and width adjustment by making a test cut in scrap. Then mark a pair of reference lines at the edges of the test-cut dado on the saw table. Note that a full groove, rather than a blind one, is cut for the 16-in. shelf. A filler strip is then inserted to render the groove "blind."

If you don't own a table saw or dado cutter, you can cut the rabbets and

dadoes with a router, using a rabbeting bit and a straight bit (for edge rabbets and dados, respectively).

Clamp two straightedge strips to guide the router base when making a 3/4-in.-wide dado in two passes. Feed the router alternately against each guide to make the full-width cut. Edge-rabbets 3/8-in. wide can be made

(Please turn to page 146)

"You'd have to whip me to get this tractor away from me."

Bill Hendrickson, Arthur, Illinois



It's been 13 years now since Bill Hendrickson bought his John Deere lawn and garden tractor.

Over the years, he's given it plenty of hard use—mowing grass and weeds, pushing snow, pulling wagons, and doing other odd jobs around his place.

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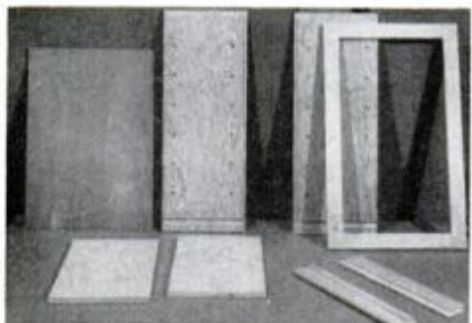
17 Glue and nail corner braces; don't let nails penetrate the front.



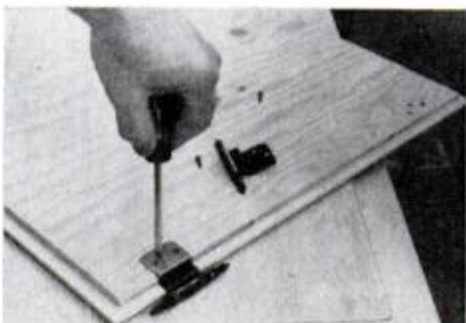
18 Nail-points in miter gauge extension grip work while cutting dados.



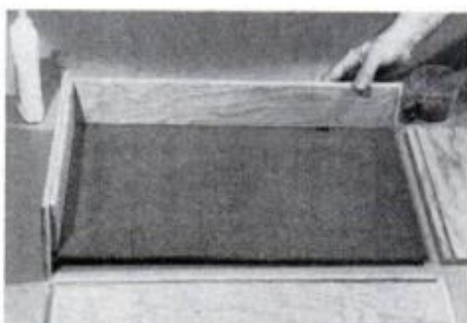
19 Set depth stop on a drill press to bore the shelf bracket holes.



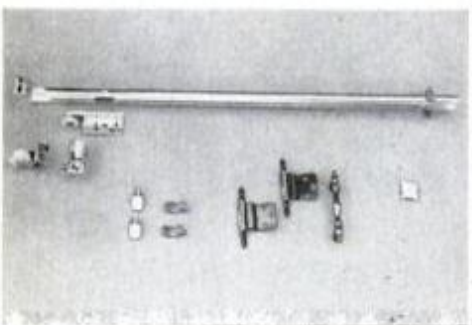
20 Wall cabinet parts, excluding door and hardware, ready for assembly.



21 It's easier to screw semiconcealed hinges, pull, catches, brackets.



22 Attach drawer sides to front, then insert bottom, install back.



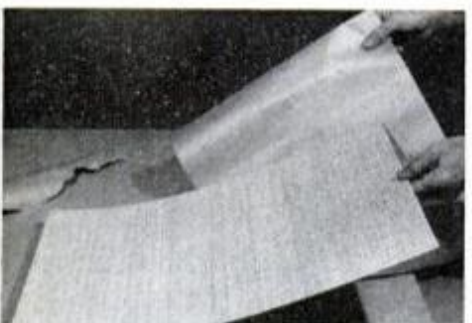
23 Cabinet hardware: Drawer slide, hinges, pull, catches, brackets.



24 Follow maker's instruction to install bottom-mount drawer slide.



25 Nonflammable laminate contact cement goes on milky, turns clear.



26 Use kraft paper to keep surfaces apart when aligning the laminate.



27 Use router and straight carbide cutter to trim laminate overhang.



28 Set backsplash in caulk, fasten it to counter with fh screws.

by using a cutter with a pilot bearing. A straight cutter and a guide must be used to make the $\frac{3}{4}$ -in-wide end rabbets.

After you cut the grooves into the side panels, use the table saw (or portable circular saw) with its blade set high enough to cut out the toe-space setback. Make two right-angle cuts to the corner, after which you should fin-

ish both cuts neatly with a handsaw.

The front frame is constructed of solid wood, such as pine or birch. When cutting the lap joints, first make test cuts on scrap to make sure that the depth-of-cut is precisely half the wood thickness. Identify all matching parts with penciled numbers or letters. Assemble all joints with glue and $\frac{5}{8}$ -in. brads to prevent movement while

clamping. Note: Do not position a brad where it may interfere with your rabbeting of the frame.

When all parts have been cut, sand and dust the inside surfaces and apply a coat of sanding sealer (or thinned shellac). Then resand lightly by hand using 220-grit production paper. Do not apply sealer to any parts that will

(Please turn to page 177)

Central air conditioning can be cold comfort if it costs too much to operate.

Introducing the Sears Green\$avers

These days, it can take a lot of green to cool your home. Because energy costs money. So depend on Sears. We're experts at controlling the cost of temperature control. We'll help you keep a lid on the expensive energy your home's air conditioning and heating systems use.



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When you buy a Heil Hermitage air conditioner, you can expect to get a professional installation—from a dealer who knows the air conditioning business. He also knows he has the Heil reputation to protect. So you can count on prompt attention after the sale if you ever need it. Your Heil dealer will work hard to earn your trust, with quality service that's often too hard to find these days.

An air conditioner that saves energy is important, too. Heil Hermitage



air conditioning systems have good E.E.R. (Energy Efficiency Ratio) ratings. And they run quietly thanks to our patented solid-state variable speed fan control.

Look for Heil in the Yellow Pages. We know you'll like what you find.

HEIL
HEATING & COOLING



Tub-shower unit you can install without fuss

An ideal replacement for outmoded bathtubs, this five-piece tub-shower combination is a convenient step in updating your bathroom. The sectionalized system, called Combobath, is made by Universal-Rundle Corp., and includes three wall sections, a tub and an optional top section. All the parts are of lightweight material and thus easy to handle.

The 5-ft. bathtub is made of acrylic-faced fiberglass. It weighs 40 lbs. less than a steel one of the same size.

The three wall sections are vacuum-formed ABS plastic. With some adaptations they can also be used with other tubs.

Installation is relatively simple. First, fit the tub in place. (In the case of a new installation, fit the tub against the wall studs and install drywall above and surrounding it.)

Apply mastic to the drywall and mount the two end-wall sections; then add the center-wall section in the same manner.

A rubber-silicone sealant is furnished in the same color as the walls. Apply it to all joints of the completed unit to

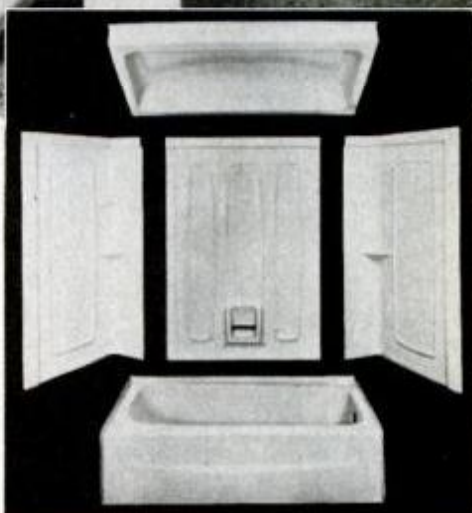


Installed tub-shower is one of several convenient bath packages made by U-R.

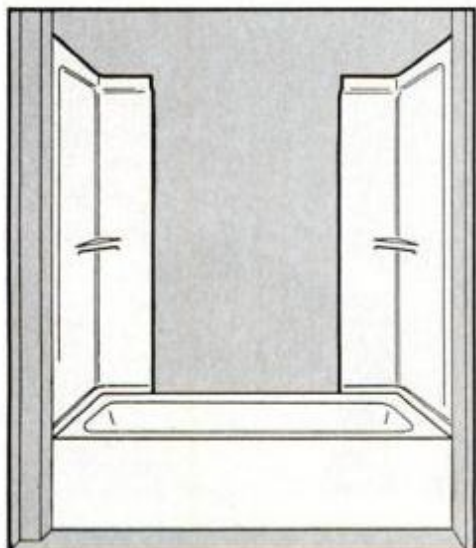


make it leakproof. Add the optional top if desired. Then install the plumbing fittings.

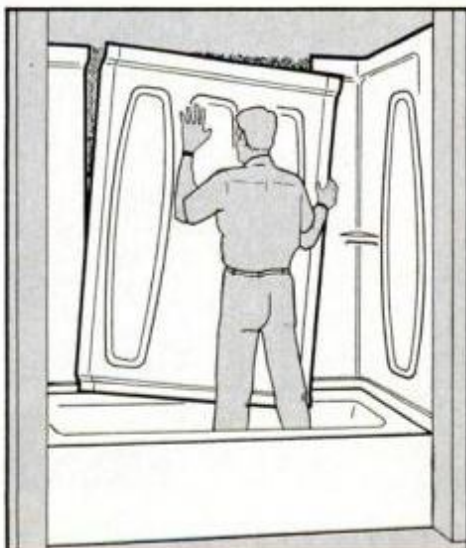
The Combobath is available in white, green, Marble-creme, gold and blue colors with a choice of right or left bath outlet. It has a three-year warranty. Cost of the five-piece set is \$344; if you don't want the top, the other four pieces sell for \$287. Universal-Rundle, 217 North Mill St., New Castle, Pa. 16103.



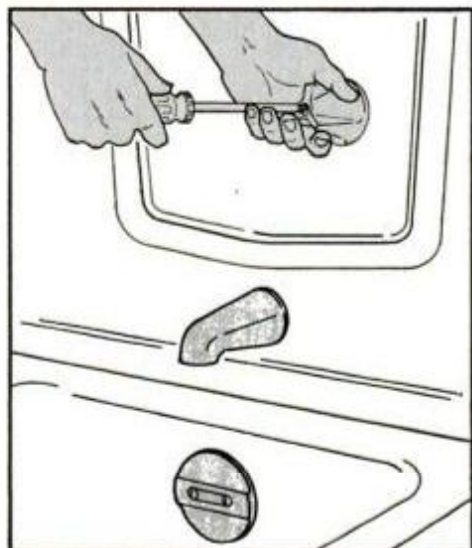
The Combobath unit is composed of three wall sections, a tub and optional top.



After the tub is installed, apply mastic and fit the two end sections on the walls.



Next, carefully position the back section. Color-matched sealant closes in joints.



Place the optional top in position if desired and install the plumbing fittings.

SuperSander™

**It outperforms
ordinary
sandpaper
up to 10 to 1.
And that's a
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SuperSander cuts faster. Lasts longer. And resists tearing better than ordinary packaged sandpaper. Try it.

You'll agree SuperSander is the best sanding product you've ever used, or Carborundum will give you your money back.

Look for SuperSander belts, sheets and pressure sensitive discs wherever you buy power sanding supplies. Or write for the address of the SuperSander dealer nearest you.

The Carborundum Company
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CARBORUNDUM



12 instant fix-ups for your bathroom

You can inject new livability into your bathroom with accessories that can be added in a single work session: Expensive and expansive remodeling isn't the only way to upgrade that room's looks.

New bath products that are appealing as well as useful, and new bathroom designs that include dressing and relaxing areas, are making the room more pleasant now.

Since the bath, like the kitchen, plays such an important role in our everyday

(Please turn to page 152)



No fear of water damage to the sill when you grow plants on this cultured marble Sill Extension. The 8x33-in. tray, from BRD Functional Innovations, Box 264, Westville, N.J. 08093, sells for \$23.

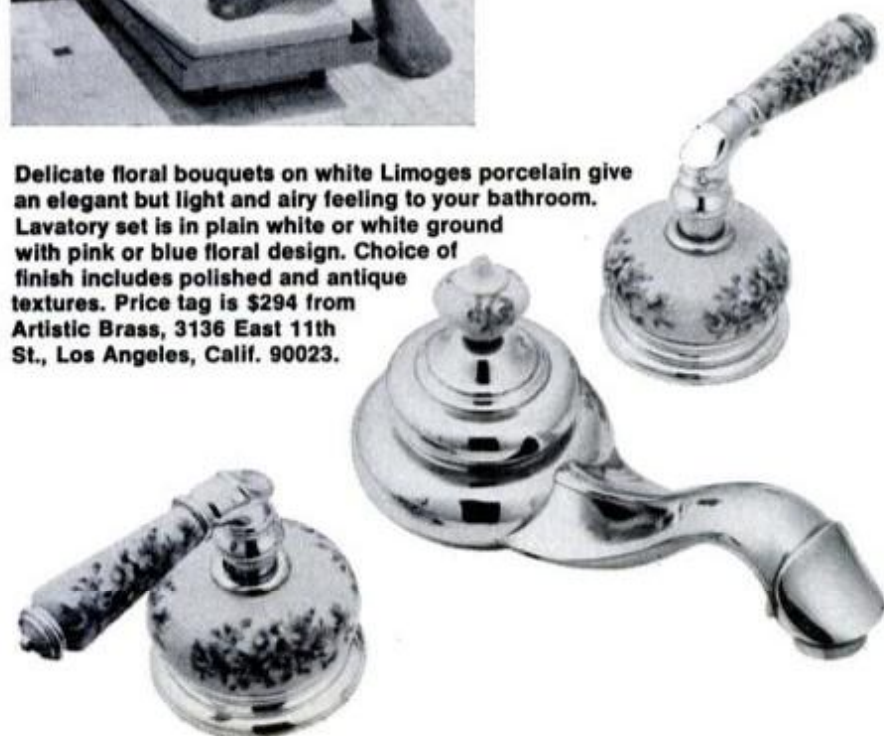
This bath scale in chrome or brass folds into wall for safety and convenience. costs under \$100 from Scovill, Madison and Red Bank Rds., Cincinnati 45227.

The Exquisit faucet has a thermostat that gives the same water temperature with each use. Unit is \$340 from Grohe, 1591 Elmhurst Rd., Elk Grove Village, Ill. 60007.



Delicate floral bouquets on white Limoges porcelain give an elegant but light and airy feeling to your bathroom.

Lavatory set is in plain white or white ground with pink or blue floral design. Choice of finish includes polished and antique textures. Price tag is \$294 from Artistic Brass, 3136 East 11th St., Los Angeles, Calif. 90023.



Use the elements of this Heat-A-Ventlite (heater, ventilator, light) alone or together. It's \$107 by Nutone, Madison and Red Bank Rds., Cincinnati Ohio 45227.

The beauty treatment

Antique Oil Finish
for woods of all ages

Restores . . .

vitality to an old finish without stripping, adds value to antiques.



Refinishes . . .

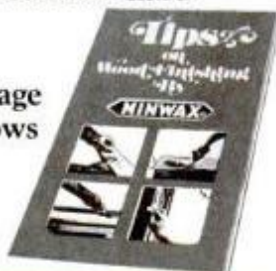
damaged surfaces with a durable, easy-to-maintain finish.



Rewards . . .

pre-or-unfinished wood with soft, clear lustre and hard protection.

FREE 16-page booklet shows how easy it is to use.



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MINWAX

'78 Home Ideas Guide

12 BATHROOM FIX-UPS

(Continued from page 151)

life styles, it pays to give adequate thought to its design and usability. For that reason PM's home and shop editors have rounded up a dozen good ideas for making your bath surroundings more pleasant to look at and live with. Most of the products shown can be installed by an average-skill do-it-yourselfer. The time spent on these fix-ups will be well worth it in terms of comfort, beauty and satisfaction in updating your home.

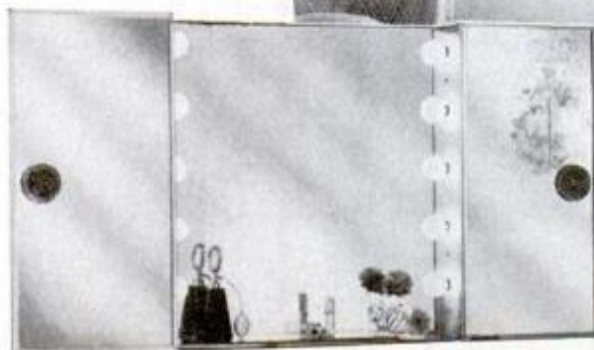
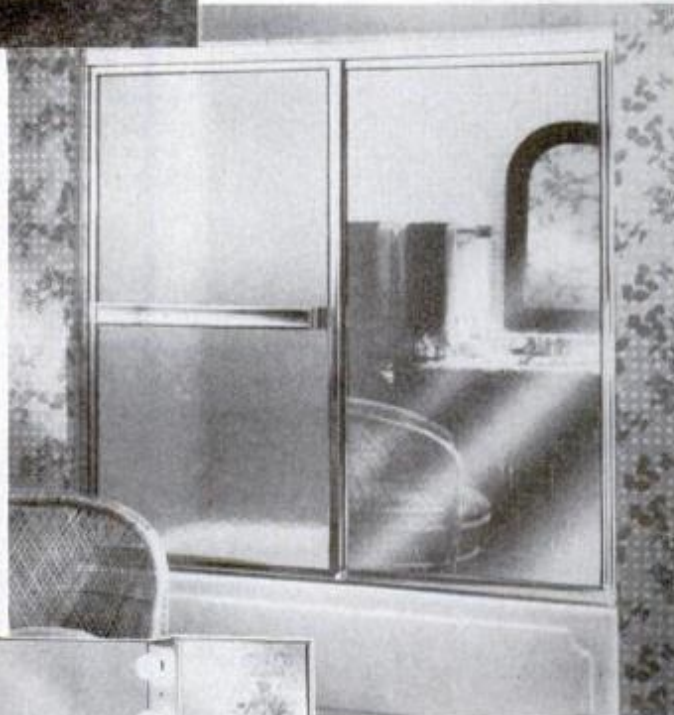
(Please turn to page 154)



This Heirloom bath cabinet in walnut or maple finish fits well in traditional bathrooms. It has a handy drawer with antiqued brass and porcelain hardware. Miami-Carey, 203 Garver Rd., Monroe, Ohio 45050, makes it. Price: \$132.

The Assemble-Pak cuts down on legwork by gathering needed lavatory parts: Faucet, white vanity and china top in white or color (packed separately). Prices start at \$184; Universal-Rundle Corp., 217 North Mill St., New Castle, Pa. 16103.

A mirrored tub enclosure such as this Showerglide Series 1100 visually maximizes bathroom space and is a luxurious touch. The gold or silver-finished anodized aluminum frame is made to install easily. Under \$100. Kinkad Industries, 2801 Finley Rd., Downers Grove, Ill. 60515.



There's mirror space aplenty when the doors of this 10-light cabinet are opened for three-way view. A grooming shelf rests between the doors. \$230, Thomas Industries, 207 East Broadway, Louisville 40202.



Your redwood dream deck. Now it can be different from anyone else's redwood dream deck.

A deck that's all your own begins with a design that's all your own. Design your own redwood deck with the Redwood "Design-a-Deck" Plans Kit.

- Adaptable patterns for an endless variety of decks to suit your home and landscaping
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Then you can build your deck yourself with natural, low-cost garden grades of redwood.

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Each plans kit contains five large sheets of working drawings; a complete list of required materials; a 20-page, illustrated step-by-step manual; graph paper and unique punch-out patterns to help you decide exactly where to place your deck; information on hillside installations; plus detailed plans on steps, benches and railings.

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I'm enclosing a ☐ check ☐ money order for \$4.00.
Please send my deck plans kit.

Name

Address

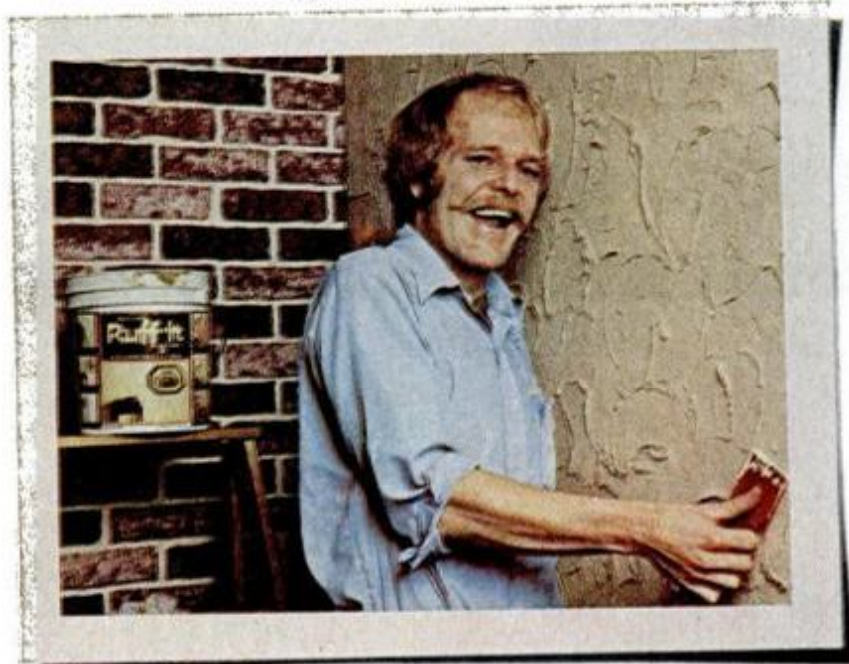
City

State Zip

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New Ruff-It^{T.M.}

lets you
sculpture bold, rough walls
yourself!



"HEY, you'd think I was a pro but I never did it before in my life! The secret is Ruff-It, an acrylic finish that's easy to use because it doesn't set up too fast. You can try all sorts of dramatic effects . . . smooth it on, rough it up with a trowel like I'm doing, pattern it, carve it with a spackling blade, brush it, comb it or actually sculpture it with your hands!

Ruff-It is neat because it's ready to use—no messy mixing or measuring. It's crack-resistant. And it comes in 6 colors that go great with the warm, rustic colors in our Z-Brick walls. That's how we got a terrific wall and ceiling, too, without paying an arm and a leg for it."



Ruff-It^{T.M.}

Acrylic finish for walls
& ceilings

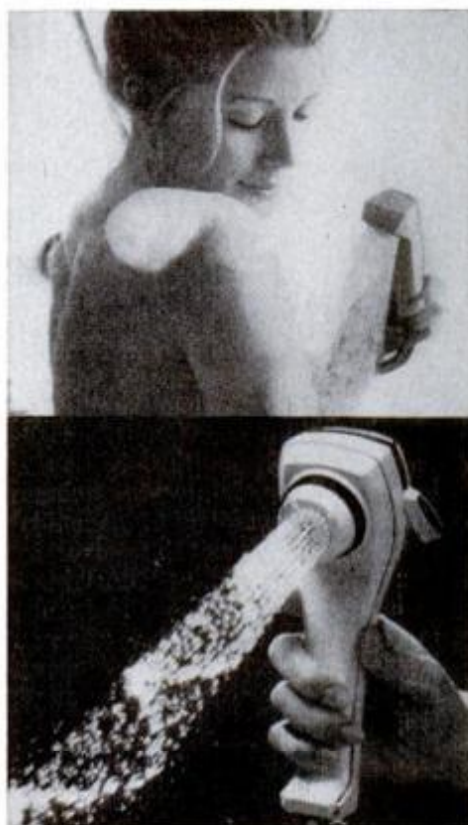
BY Z-BRICK[®]

Get a free color brochure. Write: VMC Corporation,
Dept. PMAR, Woodinville, WA 98072.

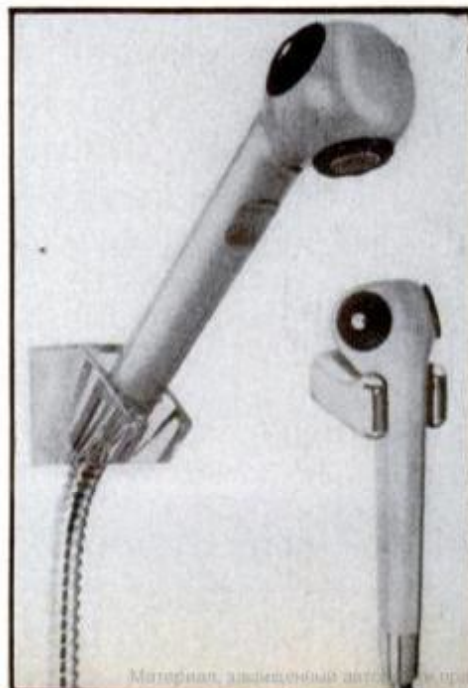
78
HG

12 BATHROOM FIX-UPS

(Continued from page 152)



Hand-held showers offer several advantages over wall-mounted showerheads. With a portable you can shower easily and keep your hair dry, bathe children, localize your bathing and clean the tub and walls. The Raindrop (top photo) is \$27 and up from Kohler Co., Kohler, Wis. 53044. The Pulsation (above) delivers water in several pulsating or steady spray pressures. Moen, 377 Woodland Ave., Elyria, Ohio 44035, sells it from \$18. Daisy three-spray shower (below) has three different sprays from invigorating to gentle. It's by Ondine, 3231 North Durfee, El Monte, Calif. 91732, \$38.



Anything you plant in your garden wants to grow, and if the soil's halfway decent and you give it just a little help, it will. (And your own fresh peas, beans and sweet corn will not only save you some money with every meal, they'll likely taste better, too.)

Use Scotts Vegetable Garden Fertilizer once. (Just once.) See what a crop you get.

The chief difference between getting, say, up to 10 pounds of tomatoes and only half that much is simply fertilizer.

And you don't have to make a career out of putting it down.

We've created a vegetable garden fertilizer you

use just once a planting.

It has enough nourishment in it to last for your entire crop.

(This is different from quick-release fertilizers that give you a burst of food right away and then run out on you. They're the ones that tell you to "apply" two or three times.)

We make our fertilizer so that it releases nitrogen gradually, enough at first to get your plants off and running, and then a little more week after week.

It's this steady feeding that helps give you all those extra tomatoes, beans and corn. And one feeding is

Up to twice
the tomatoes
with just
one feeding.

enough unless you're in the South and have sandy soil.

You can use this fertilizer on all your vegetables and you don't have to worry about harming them. It's a slow-release fertilizer, so it won't burn. Just follow the directions on the box.

The best time to use it is when you plant your seeds or seedlings. Just spread it as evenly as possible and work it into the soil an inch or two.

We've tested this fertilizer ourselves on all sorts of vegetables so we know what it can do. And we sell it with the simplest guarantee we can think of. "If for any reason you are not satisfied with results after using this product, you are entitled

to get your money back. Simply send us evidence of purchase and we will mail you a refund check promptly."

You won't have to go looking for us. We'll be right here in Marysville, Ohio.



How to reroof your house like a pro

'78
Home
Ideas
Guide



PM photos: Carl Weese

Whether you do it yourself or have it done for you, it pays to know the right way to reroof with asphalt strip shingles. Here's how.

by Joseph R. Provey

ASSISTANT HOME AND SHOP EDITOR

The kerplunk of a leak in a bucket or pan makes the need for a new roof obvious. But you're in trouble if you wait until that stage before re-roofing. If your roof is 15 or more years old (20 years is the average lifespan for an asphalt roof), now is the time to check for badly curled, cracked or missing shingles. Bare, dark, smooth patches—where the mineral granules have worn away—also signal that you will soon need a new roof.

Since the south and west roof slopes take the most punishment from weather and sun, always start your roof inspection there. And if you are not comfortable or experienced at scampering about on a roof, you should call in a reputable local contractor to make the inspection for you.

When buying shingles, you may choose from an abundance of styles, but should also consider color, weight and fire and wind-resistance ratings. Light-colored shingles will reflect summer heat and lower airconditioning

costs. Heavier-weight shingles usually mean longer roof-life guarantees. The three-tab, self-sealing strip shingles shown weigh 240 lbs. per square. One square equals 100 sq. ft. of roof. UL-approved shingles, Class A, B or C, are all suitable for residential use. A *Homeowner's Guide to the Selection of Quality Roofing* can be obtained for 35 cents from ARMA, Box 3248, Grand Central Station, New York, N.Y. 10017.

Shingles are ordered by the square. Include one roll of 15-lb. roofing felt for every four squares. Specify where you want your order unloaded to save extra lugging. Store shingles off the
(Please turn to page 158)



Holster on belt keeps hammer handy. Apron around waist holds nails and knife.



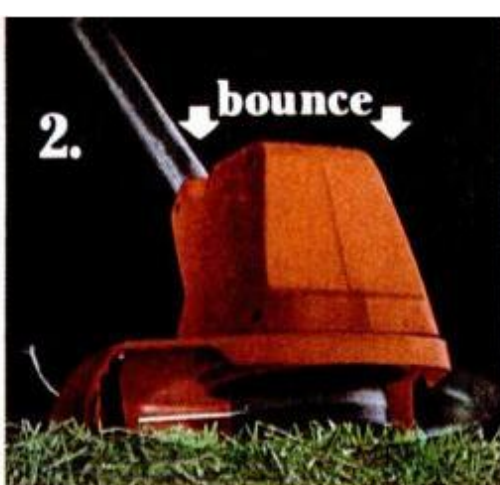
Balance bundle on shoulder, steadied by arm—leaves one hand to grip ladder.



To unload, let bundle slide forward, then flip top end forward with shoulder.



1. Time for fresh line on your Toro trimmer? No need to feed out line and cut it by hand.



2. A mere tap on the ground while you trim triggers a spring-loaded mechanism that...



3. ...automatically advances fresh line and cuts it to the proper trimming length.

Toro® takes the stop-and-go out of grass trimming

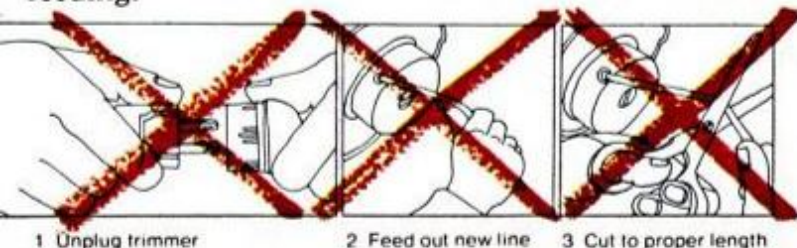
Toro engineers drew on over half a century of lawn-care experience in designing this heavy-duty flexible-line trimmer.

Of course, you get the quality and convenience you expect to find engineered into any Toro.

Feeds line automatically

Toro saves you time and trouble with its fully-automatic feed. You simply tap your Toro on the ground and it automatically lets out new line, then cuts it to the proper length *while you trim*. No stopping, no unplugging.

You avoid the three-step hassle of manual feeding.



Our fully-automatic feed is a significant advance in trimmer design. It's a spring-loaded device which now allows continuous trimming with no stopping to advance new line.

A few other outstanding features make this heavy-duty trimmer a worthy addition to the Toro family of quality lawn-care products.

Adjustable handle

A comfortable ring-grip handle slides up or down to accommodate the user's reach. A telescoping tubular shaft adjusts to the user's height.

Here's a Toro that's only 5.6 lbs. Anyone can handle it. You'll make quick work of grass that

shoots up along fences, walls, borders, around trees or over the edges of walks and driveways.

3.5-amp motor

Powered by a 3.5-amp heavy-duty motor, this new Toro whips sturdy cutting line around at 7,000 rpms. That's power enough to level weeds up to half an inch thick, or trim grass along a 50-foot chain link fence in only five minutes.

Cord lock handle

Like all Toro products, your new trimmer is engineered for convenience. A cord lock on the handle keeps your extension cord from unplugging while you trim. And the trimmer is double insulated against electric shock.

The complete Toro trimmer line also includes cordless and gasoline-powered models.

Quality engineering is what makes this new heavy-duty trimmer a Toro. You'll be glad you waited.



Haven't you done without a Toro long enough?



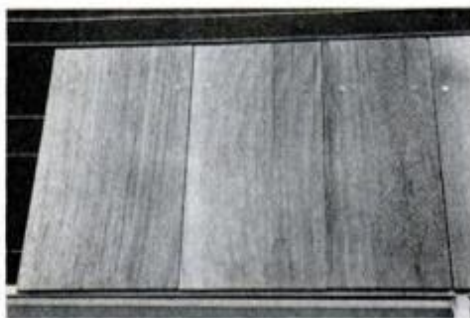
Basic roofing skills and techniques



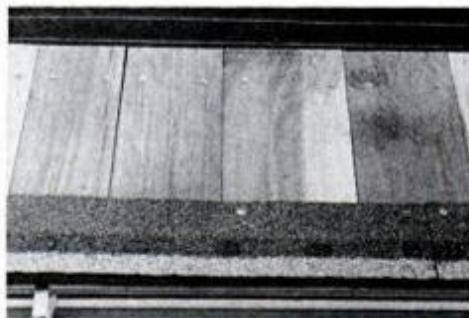
Score shingles to make starter strips using framing square for straight edge.



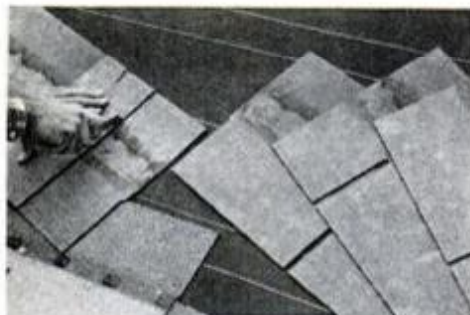
Break on score to finish cut. For easy cutting, keep shingles out of hot sun.



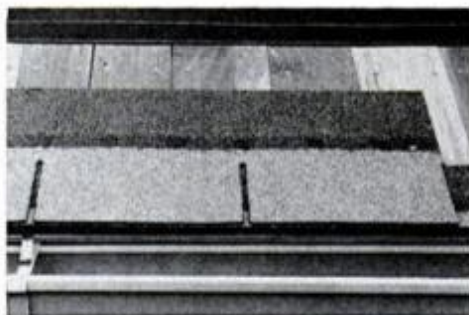
Underlay course of cedar shingles supports 3/4-in. asphalt shingle overhang.



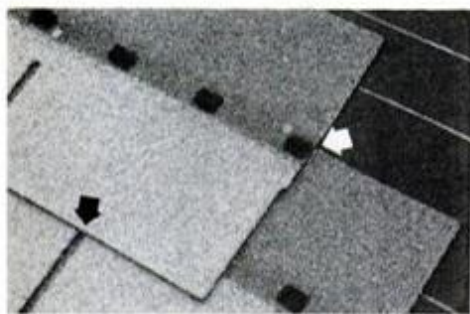
Lay starter strip from ladder or scaffolding with the adhesive dots exposed.



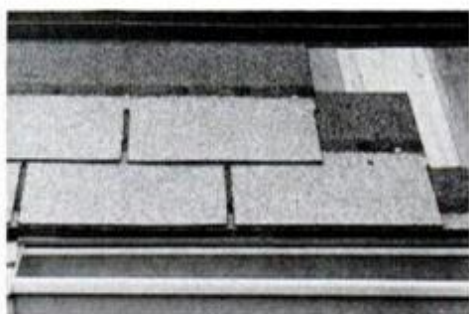
Use a template to assure accurate cutting of half-tab starter shingles.



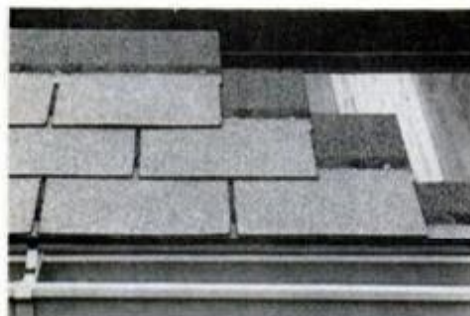
Be sure first course drip cutouts don't align over starter-strip joints or nails.



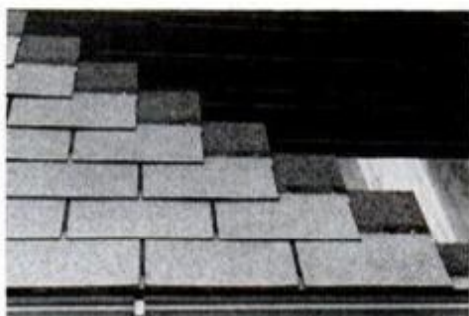
Use top of drips and small ready-cut slits to check the alignment of next course.



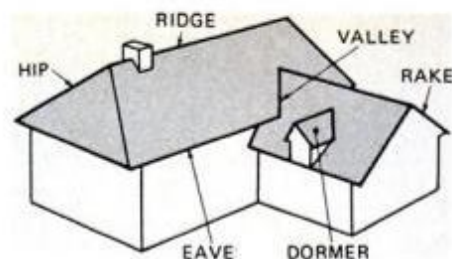
Second course begins with shingle one-half tab shorter than the one beneath it.



Nail down shingle on line 1 in. above drip cutouts and 1 in. in from both ends.



Continue shingling in stepped pattern to minimize color shading inconsistencies.



HOW TO REROOF YOUR HOUSE

(Continued from page 156)

ground under a ventilated covering, or indoors if possible.

Gather all materials, tools and equipment before you begin. Scaffolding, safety harnesses, ladders and even staple guns can often be rented. Roof brackets and 2x6 planks can be used to facilitate walking on a roof with a pitch greater than 6/12 (a roof that rises 6 in. vertically for every 12 in. of horizontal run). Familiarize yourself with the use of the equipment before you begin.

Applying asphalt over asphalt

It is not necessary to remove one and sometimes even two layers of existing asphalt shingles before reroofing. Roof framing, however, must be able to support the weight of the new roof—as well as support workers and meet local snow load requirements. The old roof must also provide a solid base for nailing. Obtain a professional opinion if in doubt about this.

To prepare an old asphalt roof for reshingling, remove any protruding nails, nail down loose shingles and replace ones that are missing. Badly curled shingles should be split with a knife and the segments renailed. Sweep the roof surface clean of debris before beginning. Also inspect flashing to see if it can stay and be reused. (See flashing notes, page 161.)

If you do not have metal drip edges at all edges, install them now. Space nails 10 in. apart and close to the inner edge. Drip edges along eaves should be applied before felt underlayment; the drip at the rake, after.

Installing 15-lb. felt before proceeding to reroof over existing asphalt shingles is optional. Don't use heavier felt; it may act as a vapor barrier and collect damaging condensation between roofing and sheathing. On typical slopes (4/12 to 6/12), overlap the felt 2 in. on the horizontal and 4 in. on the vertical. Lay felt in the valleys first and then lap the ends of the horizontal courses over it for at least 6 in. Use a minimum amount of nails or staples to secure at edges and seams; trim any excess flush to rake and eave edges. Optional method: To form a neat, clean edge along an eave, cut back the first course of ex-

(Please turn to page 160)

Introducing Ferrothane.[™] Nobody's ever seen plastic rust.



Now you can seal outdoor metal things—like this wrought-iron table—in plastic with the wrist-and-brushwork of an ordinary paint job.

It's a cinch with Ferrothane Plastic Finish—the new outdoor metal coating from Flecto, the makers of Varathane[®] Liquid Plastic. You don't even need a primer.

Just brush Ferrothane over whatever prepared metal surface you'd like to shield from the elements: wrought iron furniture, gates, grillwork, garden tools, a storage tank, toys. Thanks to Ferrothane's ingredient Rustaid you'll get



chemically formulated protection against rust and corrosion.

You'll also get a terrific-looking finish in a choice of 12 Ferrothane colors. Plus a coating that levels itself, spreads evenly, and dries in 4 to 6 hours. And gives outdoor metal things tough, long-lasting protection against rust, corrosion, mars, nicks and chipping.

How long will a coat of Ferrothane last? Well, when was the last time you saw plastic rust?

The Flecto Company, Inc.
P.O. Box 12955, Oakland, Ca 94604

To stop rust use Ferrothane.

HOW TO REROOF YOUR HOUSE

(Continued from page 158)

isting shingles a few inches before laying felt. Then nail the wood shingles in position (fat edge down) over felt as shown in photos.

Starter strips help seal down the first course of full shingles. To fashion strips, cut off the part of shingle that would normally be exposed (butt tabs), plus 2 in. from top of shingle. This leaves a strip 5 in. wide. Position these strips flush with the old eave line and nail them to the roof 4 in. above the eave edge. Space nails so

as not to align under first-course drips (slit-shaped cutouts in each shingle).

If the roof span is less than 30 ft., it's easiest to start your courses at either rake end—or at the rake opposite valleys and other junctures when they occur. Start longer spans in the center to help avoid uneven rows. When you nail over a single layer of asphalt shingles, use 1 1/4-in. galvanized steel or aluminum roofing nails—use 1 1/2-in. nails over two layers. Nailheads should not be set into the shingle surface. Important: Read the manufacturer's recommended

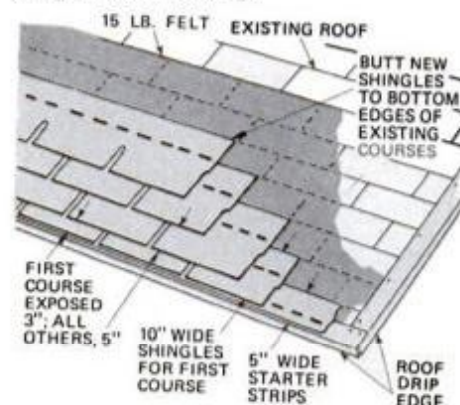
nailing pattern printed on every shingle bundle.

An easy alternative reroofing meth-



Easy alternate procedure butts top of shingles to bottom of old ones—minimizes chance for uneven appearance.

BUTT METHOD OF APPLYING ASPHALT OVER ASPHALT

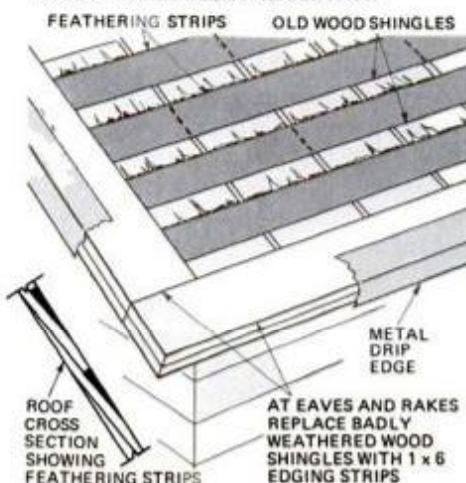


Photos: Asphalt Roofing Manufacturers Assn.



Feathering strips, called horsefeathers, can be used to level cedar-shingle roof before reroofing with asphalt shingles.

WOOD SHINGLE DECK PREPARATION



Bolens®



Discover the mower that discovered mulching.

The Bolens Mulching Mower™ not only cuts your grass it also cuts and re-cuts the clippings into tiny mulch particles that are fed back to your lawn. No raking, bagging or clean-up. And no confusion about the quickest, cleanest way to mow: the one and only Bolens Mulching Mower™



Visit your Bolens dealer now. He's got the largest selling mulcher. The only one that's proven itself rugged and reliable. For his name, check the Yellow Pages or call **800-447-4700** toll-free anytime (in Illinois, call **800-322-4400**). FMC Corporation, Port Washington, WI 53074.

You're a good yard ahead with Bolens.

FMC

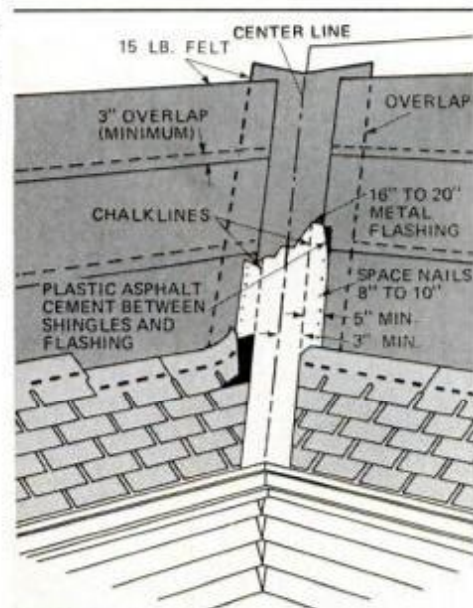
Bolens Mulching Mower is a Trademark of FMC Corporation. © 1978 by FMC Corporation.

od aligns courses automatically—provided that old shingles are straight. The chance for uneven buildup of roofing materials is minimized. Lay starter strips as previously described. Then cut 2 in. from the top of first-course shingles and lay them butted against the bottom of the old, third row of shingles. (See diagram and photo.)

Reshingling over wood shingles

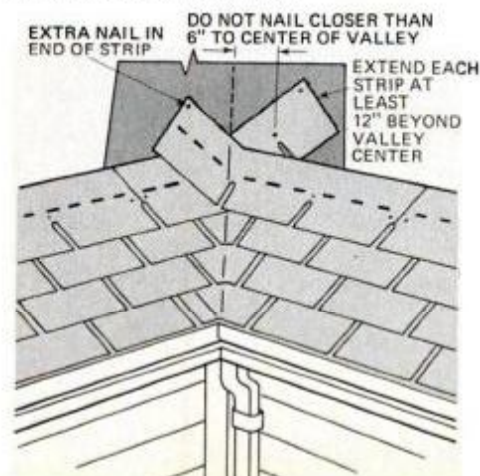
Prepare and check framing for soundness as you would for an asphalt roof. If wood shingles are badly rotted, use a shovel to pry up and lift away old roofing and old sheathing

OPEN VALLEY TREATMENT



Apply asphalt roofing cement between old and new roofs along edges at valley.

WOVEN VALLEY TREATMENT



down to the rafters. New plywood sheathing with staggered joints must then be installed. Reroof new sheathing in a normal manner. If the old wood shingles are sound, except along rakes and eaves, cut them back 5½ in. and remove. For the damaged area flush with the rest of the roof surface by nailing in place 1x6s or strips to suit. Level the roof by nailing "horsefeathers" to old courses before you begin to reshingle. (See photo and diagram on the previous page.)

How to flash trouble spots

Flashing refers to the act of making

a roof watertight at all intersections and also to the material used to make the seal—usually aluminum or roll roofing. If junctures between intersecting roofs are sealed with aluminum or copper flashing, the chances are it is still serviceable and may be reused. Simply shingle to the original valley cuts and trim new shingles to match. Note: It's easiest to trim valley-abutting shingles before nailing them in place. To do so, position the shingle and then nick top and bottom shingle edges with a knife at the two points of intersection with the chalkline (see

(Please turn to page 162)

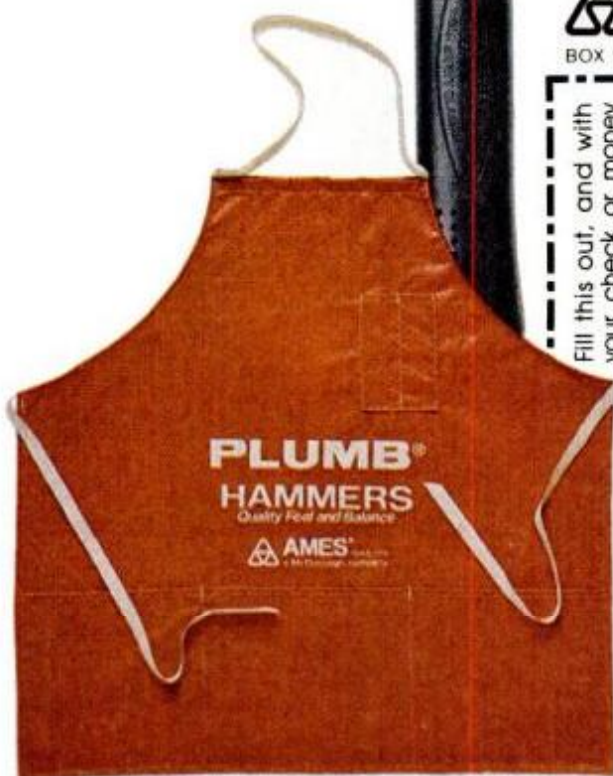
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Address				

HOW TO REROOF YOUR HOUSE

(Continued from page 161)

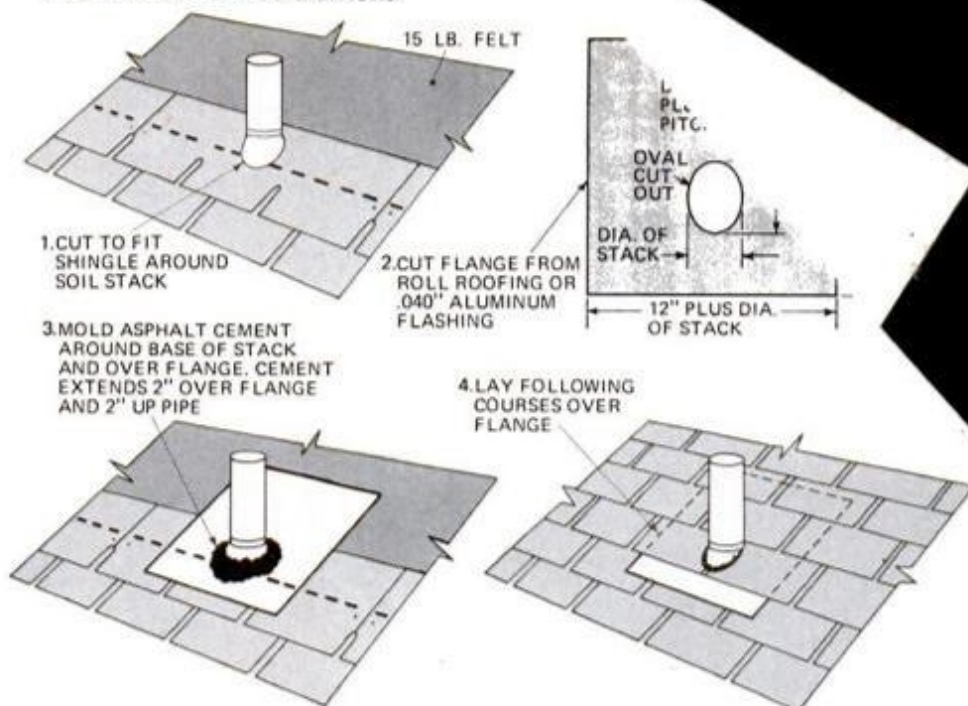
drawing). Flip the shingle over and score with knife between the two points. When applying the shingle, do not nail through the flashing. Instead, use plastic asphalt to cement the trimmed end to the flashing.

If old flashing has deteriorated or if it is composed of roll roofing or galvanized steel, it should be replaced. Either an open or woven valley treatment is recommended. Open valleys require the removal of old flashing by carefully prying back old shingles along the cut, pulling out old metal and then replacing old shingles in their former positions. For the remaining opening to the average level of the old roof. Then lay new felt and .040-in aluminum flashing sized to suit and trimmed at the bottom to fit the corner. Nail in place and strike the chalklines as shown in diagram. Trim new courses accordingly.

A woven valley treatment also entails building up the old valley opening to the average level of the old roofing with wood filler strips. Proceed with the new underlayment and shingle weaving technique shown in diagram.

The flashing at roof penetrations is

FLASHING AROUND SOIL STACKS



also critical. Note how your existing flashing is designed to carry water over the joint, not into it. If the present chimney flashing is in good condition, apply courses up to the exposed flashing at its front. Carefully lift it enough to slip new underlayment and new shingles underneath. Then press

the base flashing back into a bed of asphalt cement. Also apply at least a 6-in.-wide bed of asphalt plastic cement around the sides and back of the base. Continue to trim and set shingles to within 1/4 in. of masonry. (Do not nail shingles within 12 in. of the chimney.) Apply a liberal coating



With Elmer's Carpenter's Wood Filler you don't need a pro's hands to give it the pro's touch.



Unlike the leading wood filler, Elmer's® Carpenter's Wood Filler contains no solvents. So it's safe and non-toxic* ... perfect for repairing finished furniture as well as raw wood. What's more, Elmer's Carpenter's Wood Filler is easier to "work" and won't pull out.

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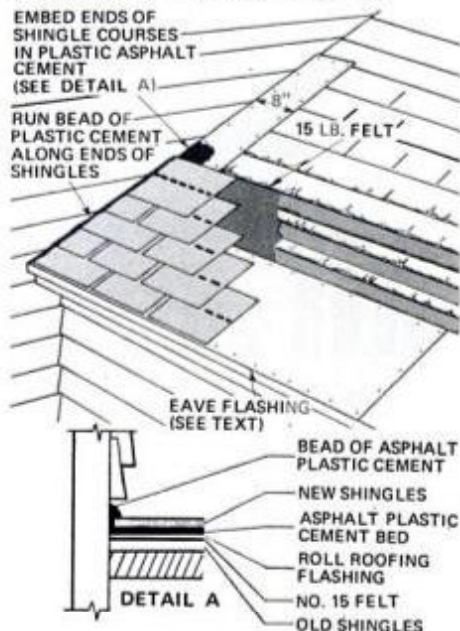
of cement between shingles that butt chimney and to all flashing seams and joints. Vigorous troweling action will eliminate air pockets in compound. If chimney flashing has deteriorated, note how it is installed and replace it.

Old flanges around the vent stacks may be in bad shape. If so, remove them and install new ones as shown on page 162. Do not nail within 8

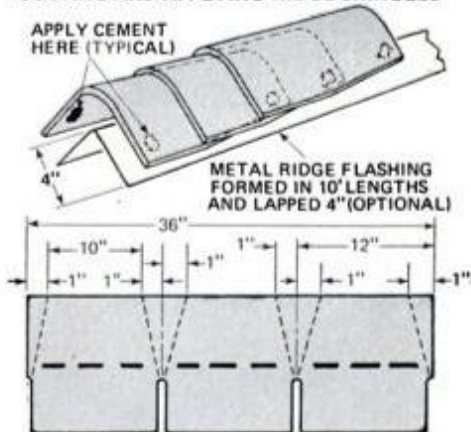
in. of the pipe. Serviceable flashing around a stack can be reused in the manner similar to chimney flashing. Lift the lower, exposed part of a flange and slip felt and shingle, trimmed to suit, up to and around the pipe. Press flange into a bed of asphalt cement; protect a circular joint with cement also. Cut opening in the subsequent shingle for a close fit around the pipe. Alternative: Noncorrodible metal pipe sleeves with preattached adjustable flanges are also used for reflashing.

Joints between rakes and vertical walls should be flashed as shown.

EAVE AND VERTICAL WALL FLASHING



CUTTING AND APPLYING RIDGE SHINGLES



Face exposed tab of ridge shingle away from the direction of the prevailing wind.

Don't nail shingle ends within 6 in. of wall. Apply the last course of a shed roof that abuts a vertical wall horizontally with asphalt cement only.

Eave flashing should be applied in regions with severe winters to prevent water backup when eaves become iced. Use 50-lb. smooth roll roofing or 90-lb. mineral-surfaced roll roofing at least 36 in. wide—wider if you have deep soffits. The eave flashing strip should overhang the roof $\frac{3}{8}$ in. and be applied with as few nails as necessary. Rake flashing (optional) may be applied in the same way as eave starter strips—except that full shingles can be used. Orient cement dots toward rake edge to help seal the end of each course.

Flashing beneath ridge and hip shingles should be of aluminum or roll roofing to prevent roof discoloration. Before applying it, remove the old capping shingles.

Ridge and hip shingles can be cut from full strips or leftover shingle scraps. Nail placement is $5\frac{1}{2}$ in. back from exposed shingle edge and 1 in. in from either side. Dabs of asphalt cement help conform the unnailed head portion of a shingle to the ridge. The last capping shingle in a row must be nailed in place on either side—dab cement over exposed nailheads. **FM**

LET'S CLEAR THE AIR ABOUT SPRAY PAINTING.

When it comes to spray painting, most people are still in a fog. Literally. No matter how much easier it is to spray than brush, you end up painting more than you intended. You can't get away from it with air compressor paint sprayers.

Wagner Spray Tech came up with a solution to all that pollution. The Power Painter. An electric, airless spray painter that applies latex, oil base paints, stains, and varnishes. And because it's airless, there is little overspray!

Power Painters W280 and W350 will paint anything from fences, to

decks, to a pontoon boat. An optional five foot suction tube allows you to paint from the paint can.

To find out more, mail in this coupon for a free Power Painting booklet.



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Please send me a FREE copy of "Discover Power Painting," an illustrated guide to quick and easy painting.

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Dept. L, 1770 Fernbrook Lane
Minneapolis, Minnesota 55441

F1

Get white TEXTURED ceilings... as easy as painting!



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The handy 10-lb. package covers approximately 150 square feet when mixed with water. And roller, brush and pan clean up easily with water.



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Illustrated "How-To" folder gives easy-to-follow instructions for mixing and application. Ask your dealer, or write Gold Bond Building Products, Division of National Gypsum Company, Dept. PM-4, 2580 Walden Avenue, Buffalo, New York 14225.



Gold Bond Building Products

Answers that make the difference.

78
**Home
Ideas
Guide**



'Paper' a wall with a paint roller



1 Snap design-textured rubber roller into tray-and-roller mechanism.



2 Pour paint—any type—into tank to nearly cover third roller inside.



3 Paint in vertical strokes. Masking tape protects ceiling, makes border.

Remember cartoons about polka-dot paint? Now you can stroke a pattern onto walls with a roller.

Long popular in Europe, design-roller painting has finally arrived in the United States. It offers several advantages over wallpaper:

- Alignment and matching are easy.
- There are no seams.
- Low cost—the pattern requires only about 1 quart of extra paint for an average-size room.
- Color choice—the colors of the design are whatever you choose.
- The pattern won't peel or tear and,

(Please turn to page 166)

THE
ELECTRICAL
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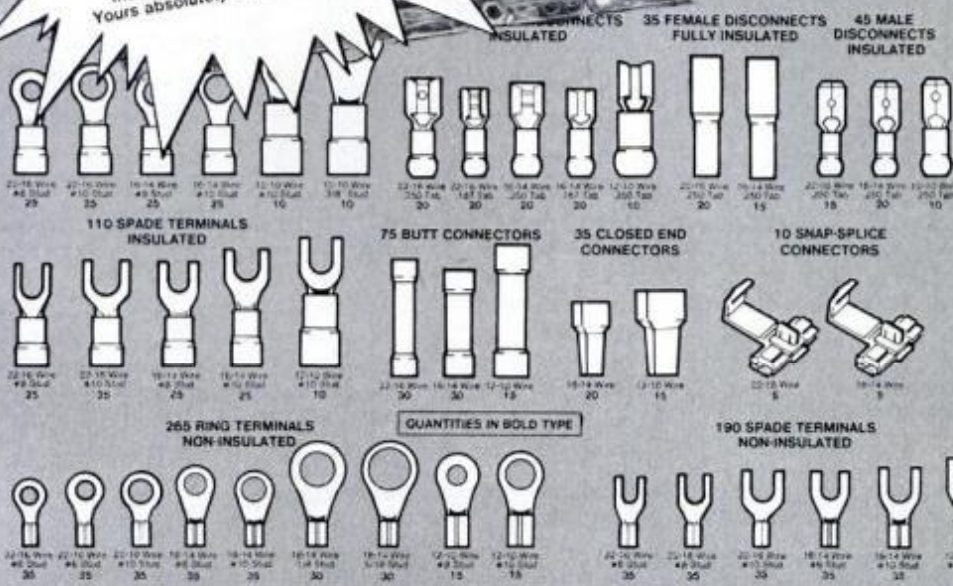
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wire and stud sizes... and
explains coding... and
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**Just about every bit
of electrical hardware
you'll ever need...
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over 84 dozen!)
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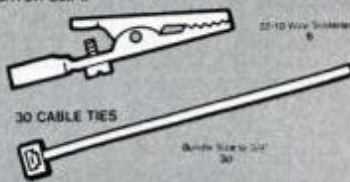
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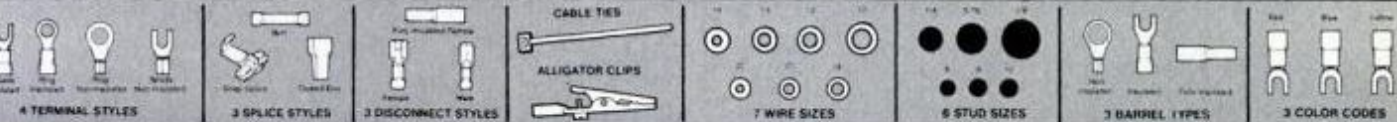
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Indicate Order: _____ Electrical Terminal & Connector Shop(s) @ \$24.95 plus \$3.90 shipping and handling each.
_____ Stanley Crimper(s) @ \$2.99 plus 75¢ shipping and handling each. (Limit: one per Shop purchased.)

Check (✓) Method of Payment: ☐ Check, money order, or company purchase order enclosed (MN residents add 4% sales tax).
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All high-quality, 99% conductivity, plated copper terminals and connectors. Meet or exceed UL, CSA, and (where applicable) OEM standards. Not inexpensive "stamped-out-tin" hardware. No "seconds" or "rejects." All high-quality! Truly over \$100 worth of hardware alone! Check out prices yourself... you'll be amazed!

Unconditional 30-Day Guarantee: If you're dissatisfied in any way or for any reason, just return your Shop(s) within 30 days for an immediate, full refund. No questions asked!

Exactly what you receive: One 25-tray, polystyrene bin-cabinet (tray dividers form 45 bins). 1,011 terminals, connectors, and electrical accessories. 25 preprinted, color-coded I.D. labels. One FREE Specifications Chart.

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D.R.I. Industries, Inc., 6864 Washington Ave. So., Eden Prairie, MN 55344

perhaps best of all, it won't have to be steamed off the walls when it's time to redecorate.

The mechanism is straightforward: a roller inside the tank-tray transfers paint—while stirring it at the same time—to an intermediate roller, which transfers it to the deeply textured design roller that contacts the wall. All types of interior paint can be used.

The technique is simple, requiring no measuring, plumb lines or chalk lines. A guide line on the roller shows where to begin each stroke. You don't have to be supersteady, because the patterns are designed to be forgiving of minor variations. After a couple of practice strokes on scrap, you'll have mastered the technique.

Masking tape on the ceiling is necessary because you begin each stroke with the textured roller in contact with it. The width of the tank-tray, slightly greater than that of the design roller, creates an automatic 1-in. side border at ends of walls, giving the pattern a framed effect. You can even produce a textured look, by using glossy paint over flat paint.

At present, 36 patterns are offered,



4 Use strip of paper towel to avoid undesired overlap at ends of walls.

including florals, abstracts, marble, wood grain and a nursery design. The distributor says that more than 100 different patterns should be available soon.

The tank-tray is \$19.95 and the de-



5 Remove masking tape to reveal border and "papering" job is finished.

sign rollers are \$6.95 each (plus \$1.50 for shipping and handling per order). For a free catalog-flyer that illustrates the available designs, write to Roller-wall, Inc., Dept. PM, Box 757, Silver Spring, Md. 20901. **PM**

Multi-Stripe like a Pro

"HOW-TO" AD #2

MULTI-STRIPE PINSTRIPING

TRIMBRITE MULTI-STRIPE GOES ON EASY AND SLICK. STICK TIGHTER, CURVE BETTER, STAY LONGER. SPECIAL REMOVABLE TRANS-PARENT CARRIER FILM KEEPS 'EM PARALLEL DURING APPLICATION. 10 COLORS... 3 WIDTHS, COMPLETE WITH SPEAR ENDS, AND VERY AFFORDABLE.

PREPARATION

CLEAN DIRT AND WAX FROM AREAS TO BE STRIPED. USE EXACTO KNIFE (OR RAZOR BLADE) FOR TRIMMING TAPE ENDS. STRIPE IN WARM WEATHER, NEVER IN SUNLIGHT.

PULL OUT ENOUGH TAPE FOR LENGTH OF PANEL. REMOVE PAPER BACKING & APPLY FIRST INCH OF TAPE. EYEBALL FOR STRAIGHTNESS... BRING TAPE GENTLY TO SURFACE. IF YOU GOOF, JUST LIFT GENTLY & REPLACE. BURNISH WITH SOFT CLOTH TO INSURE BONDING.

STRAIGHT IS GREAT!

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SPECIAL ACCENTS ON DOOR HANDLES OR NAMEPLATES REQUIRE ADVANCE PLANNING... EVEN TO SKETCHING OUT THE DESIGN. ONCE YOU'VE GOT THE PLAN, CUT ENOUGH MULTI-STRIPE TO COMPLETE THE JOB... AND DO YOUR THING! "TRIAL-&-ERROR" CAN BE THE WAY TO GO, TOO... BECAUSE WITH TRIMBRITE IT'S AS EASY TO CHANGE THE DESIGN AS TO CHANGE YOUR MIND!

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APPLICATION FOR DEALERSHIP

Dept. [PM48]

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CITY _____ STATE _____ ZIP _____

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My present occupation is: _____

My phone number is: _____

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Keep your cool with do-it-yourself solar screens

New energy-efficient screens that you can make easily and inexpensively will help you fight the heat this summer. The materials you will need to make them—fiberglass screening, aluminum framing and mounting hardware, plus a special miterbox and spline tool—are products manufactured by Reynolds Metals.

Materials cost for an average 3x5 screen is about \$16. (There's also a clear plastic film to make low-cost in-

terior storm windows using the aluminum framing.)

Solar screens will work for you in several ways. They will block up to 75 percent of the sun's heat, according to the Reynolds company, to help reduce airconditioning needs and thus cut energy costs. When windows are open, the screens turn aside heat while letting breezes in. Solar screens also can help prevent furnishings from fading. They also offer daytime privacy



Screen slides into hanger channels; two ball-head screws in sill are latches.

—you see out, but it's hard to see in.

The screens are easy to make, as shown, and even easier to maintain. An occasional vacuuming or washing with mild soap keeps them in fine shape. **PM**

MATERIALS AND TOOLS NEEDED

Reynolds Do-it-yourself aluminum sections (complete with spline)
Corner locks (4 per screen)
Hanging channels (2 per screen)
Bottom fasteners (2 per screen)
Solar screen
Aluminum center braces (for windows 3 ft. long or more)
Miterbox, spline wheel (sold with the materials)
Hacksaw and smooth mill file
Utility knife or single-edge razor blade
Tape measure



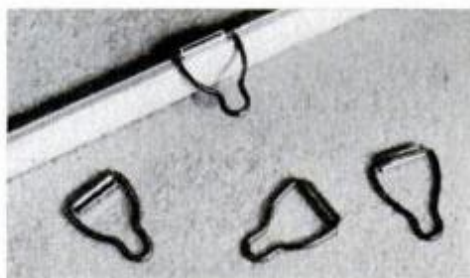
1 Measure the window. With miterbox and hacksaw cut aluminum sections (spline removed) so groove is in frame.



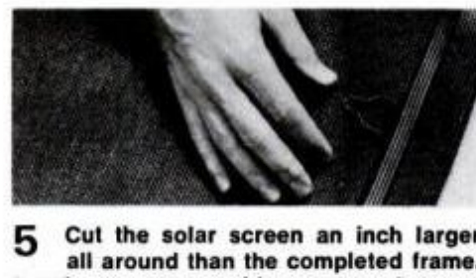
2 Go over the edges with a smooth mill file. This will make it easier to insert the corner locks.



3 Insert locks in the frame sections. If frames will be over 3 ft. long, cut aluminum center brace; snap it in frame.



4 Before inserting solar screen install two loop latches in the bottom section of each frame, 4 in. from each side.



5 Cut the solar screen an inch larger all around than the completed frame. Lay frame, groove side up, on a flat surface and place the screen on it. Start in a corner and *lightly* press the spline in the groove, working to the next corner.



6 Using a spline roller, carefully roll the spline into place. It should lock firmly. Be careful to pull the solar screen taut. However, to avoid bowing, do not pull the screen too tight when you roll the spline.



7 Next, trim the excess screen close to the outside edge of the spline, being careful not to damage the spline. The frame is ready to hang.



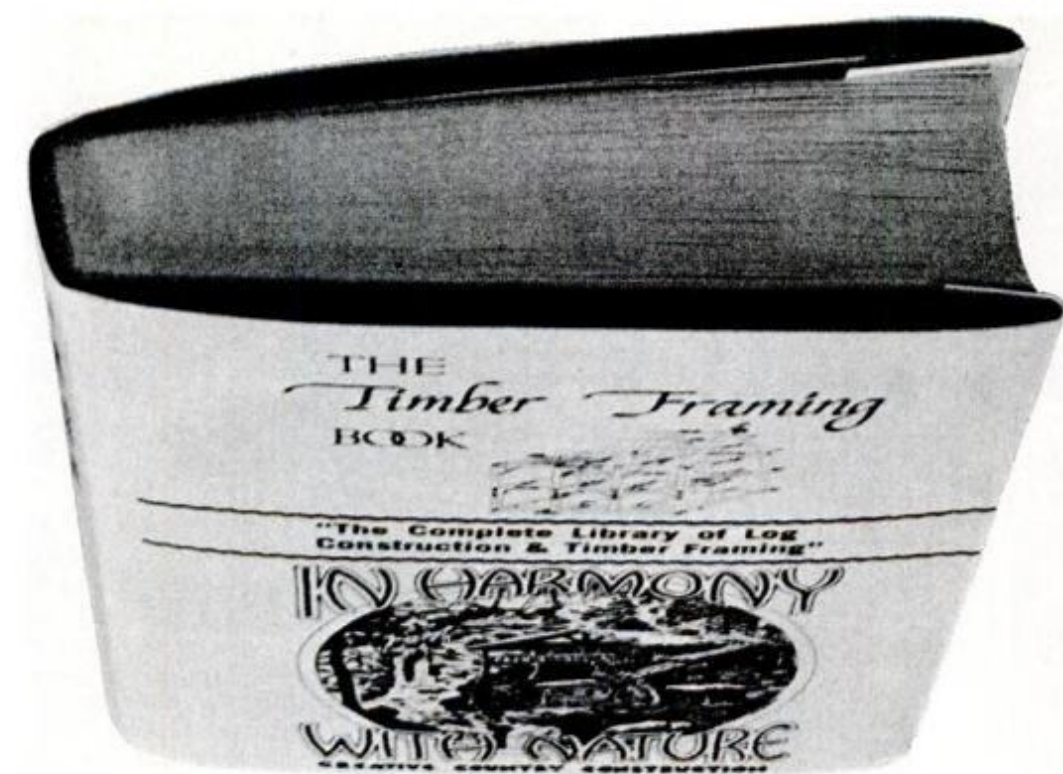
8 Install hanging channels on the outside wood frame of your window, one on each side of the frame about 1/2 in. from the top. The solar screen slides into the channels until it is flush with the top of the window.

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invites you to take a copy of "The Complete Library of Log Construction & Timber Framing" (list \$23.90) for only

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with a Trial Membership in the Book Club that saves you 25% to 75% on a wide selection of how-to books

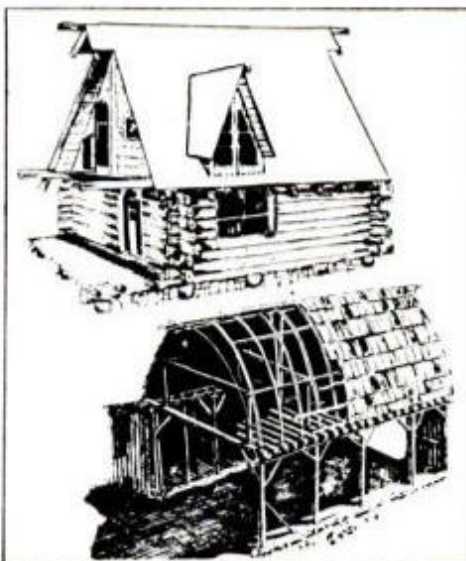


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"The Timber Framing Book"—This just-published guide to building and personalizing your own New England timber-frame house contains step-by-step instructions that tell you how



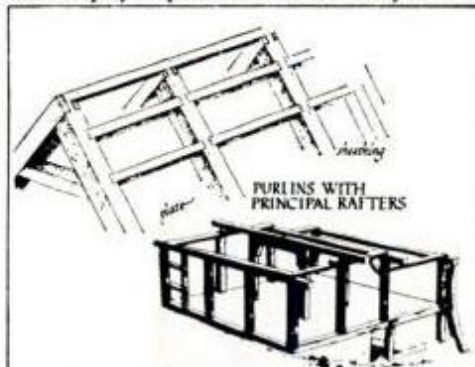
sills, joists, posts, girts, plates, rafters, purlins, braces, windows, doors, trenails, and decking.

"In Harmony With Nature: Creative Country Construction"—This beautifully illustrated handbook of log construction and living close to the land is a complete guide to how to build eight different houses (including an Olde European Exposed Beam house), 2 kinds of barns, and a super-efficient sauna—plus a load of other homestead necessities like fences, gates, fireplaces, wells, bridges, feeders, root cellars, workshops, holding pens, shingles, masonry structures, and dumbwaiters. It's a money-saving book that shows you how to construct your complete homestead from the ground up—out of logs, rough-sawn lumber, or boards from an old barn. You learn how to lay solid foundations, make your own lumber, insulate floors, make eave troughs from a cedar pole, build doors and windows, construct a fireplace, add on porches and lofts and stairways and anything you want!...plus all the furniture you'll need (again, from logs)—everything from beds to baby cribs, from chairs to serving counters.

384 pps., 845 illus. Hardbound. List \$23.90. HOW-TO BOOK CLUB Blue Ridge Summit, Pa. 17214

Facts About Club Membership

- The introductory book carries a publisher's retail price of \$23.90. It is yours for only 19¢ (plus postage and handling) with your Trial Membership.
- You will receive the Club News, describing the current selection, alternates and other offerings every 4 weeks (13× a year).
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845 really superb illustrations speak for themselves as to the quality of this helpful volume.

to plan your home from top to bottom, determine the amount of wood you'll need, join all the timber without nails, measure and cut braces, decorate timbers, cut perfect-fit rafters, raise all the pieces into place, and handle every building task. There's a whole Chapter on constructing a 12'×16' shed as a practice project, including designing it from the ground up, installing the foundation, and preparing the timbers and lumber for

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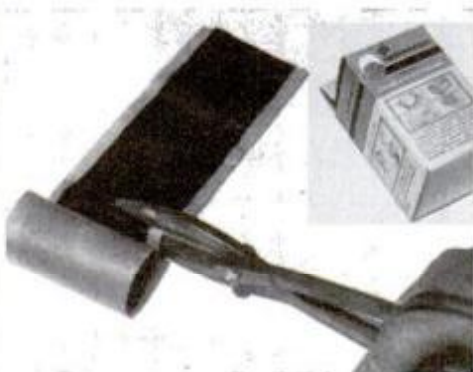
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'78
**Home
Ideas
Guide**

Stop gutter leaks in three easy steps



Tin snips can be used to make clean cuts in patching tape. If tape is very warm, some of the adhesive is likely to remain on the tool. Wipe snips clean after each use. When feasible, cut patches before climbing ladder—it is easier and safer.



Brush clean the area to be patched and press tape firmly to the surface contour.



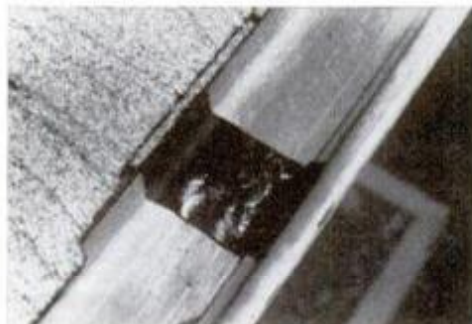
Remove the tape's paper backing and re-check the seal around patch edges. If tape has not sealed completely, use the paper backing to press it back down.

Cut, press, seal—and no more leak. Here is a synthetic rubber-based gutter patching tape which is just that simple to use. The best news, however, is that there are no messy tools to clean in solvent and no stained clothing. (Anyone who has troweled conventional asphalt patching compound over a leak knows that inevitably some of the compound gets smeared where it's not supposed to.)

Handi-Patch Roof and Gutter Sealing Tape is uniform in thickness and thus should prevent air pockets and thin spots that often contribute to faulty patching jobs. Aside from patching gutters (and downspouts), this tape repairs flashings around skylights, roof valleys, chimneys, vent stacks and stove pipes. It will also seal around windows, doors, and ventilators.

Handi-Patch will adhere to nearly any surface. No primer is needed, but do not use the tape when the temperature is lower than 40°F.

It is manufactured by the Gibson-Homans Co., 2366 Woodhill Rd., Cleveland, Ohio 44106, and is available at hardware stores and other home improvement outlets. A 2½-in.-wide roll, 30 in. long, costs about \$1.80 and will store indefinitely.—
Ronald E. Thomas



Patch is now complete. It should expand and contract with temperature changes to make a long-lasting, weather-tight seal.

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78

Entrance step you can build



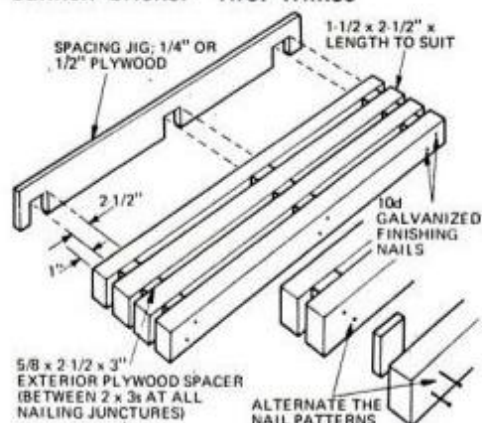
This handsome, on-grade entrance step helps dislodge debris from muddy feet before they track up the house. You can make it from 2x3s (1½ x 2½-in. lumber) and spacers cut from ⅝-in. grooved exterior siding-type plywood.

After determining the size step you want (the one shown is 44 in. x 8 ft.), cut all pieces. Apply either clear wood preservative or outdoor latex stain to all wood surfaces.

Fasten the pieces together with 10d galvanized finishing nails as shown in the drawing. Alternate the diagonal nailing pattern on consecutive pieces.

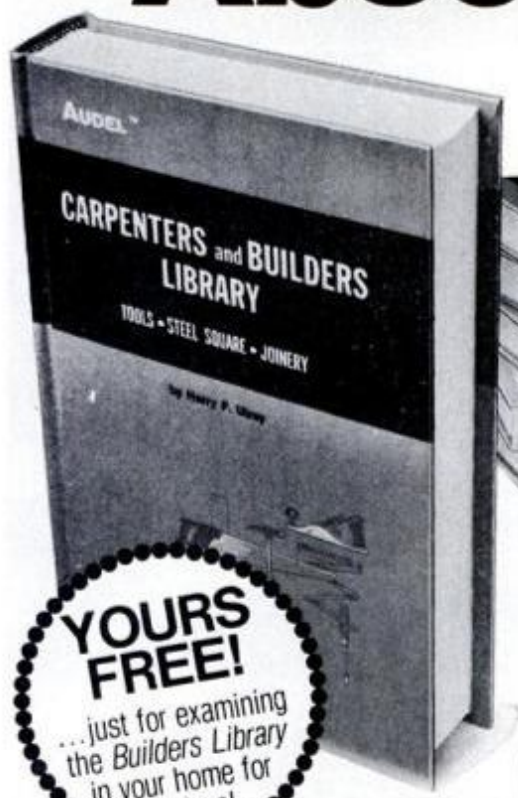
To keep the entrance step straight, start the job on a concrete floor, and work against a side wall. A jig that you can use for keeping the spacers in line will prove helpful.

You can provide some space for the accumulation of dirt by resting the step on a foundation of leveled and partially sunken bricks.—R.S. Wilkes



Wood strips, spacers form slat patterns through which mud and pebbles can fall.

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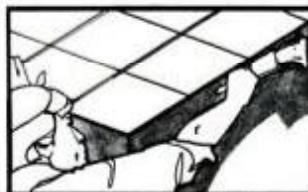


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Install a prehung door for a quick house-front up-date

Replacing an old weather-beaten door doesn't have to be a big job. Steelcraft's new Perma-Door replacement unit (shown at top right) is prehung in a steel subframe that slips into an old door's opening without your having to tear out the old jambs. A rigid, honeycomb core assures its flatness, imparts a high impact strength and provides for extra security. The core is in-

sulated with two layers of rigid foam, forming a foam-air-foam sandwich that makes this door two and one-half times more energy efficient than a solid-core wood door with a storm door. In-swinging right- and left-hand doors are available in many styles (with or without glass). Retail prices range from \$120 to \$200.

Installation is easy and can be done



First step is to remove old door and its hinges. Also remove strike plate, sill, and security devices attached to trim.



Old interior trim had to be replaced here due to damage from a forced entry. Sound trim may be carefully removed, reused.



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in one or two hours by the average handyman or woman. If your doorsill happens to be removable, it can be pried up and discarded. A one-piece oak sill/threshold combination that is an integral part of the opening frame however, would be very difficult to remove. Alternative notching procedures are suggested by the manufacturer to accommodate the new sill and threshold provided with the unit.

When fitting the door unit to the existing opening, it may be necessary to add filler strips to either the door's head (if the opening is too high) or under the sill (to add clearance for high carpeting). Filler strips may also be needed on the vertical jamb members and old door stops to obtain the required opening width. Lattice strips make good fillers. The instruction sheet that comes with the unit discusses many other special conditions.

Once the unit is in place, plumb it with a level or plumb bob before nailing the interior flange to the old frame. The jamb-anchor screws that are provided with the unit are used to secure the new jambs in five places. The unit is prepared for a Government 160 lock with a 2 3/4-in. backset. Install per manufacturer's instructions.

Use a miterbox and a backsaw to cut the wood stops to the lengths required. Tack them into position on the exterior portion of the frame with the door closed. Don't set the stops tight against the door—let the pre-attached weatherstripping form the seal. Check for ease of closing before nailing the stops.

Caulking is needed under the sill and the outside bottom edge of the wood stop. New sills are fastened to wood floors with screws through countersunk holes in the sill. Use 1/4-in.-dia. lead or plastic plugs when you're fastening the sill to the concrete.

(Please turn to page 176)



When ready to install, remove new door from carton; do not cut retainer straps until unit is secured in its opening.



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When re-attaching the interior trim, place longer finishing nails in the existing nail holes wherever possible. Fill the others with putty and touch that up to match the original finish.

To paint the door, first sand it lightly

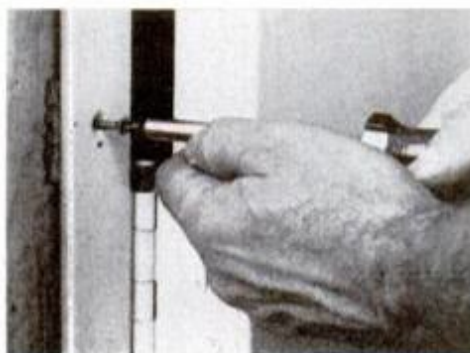
with 1/0 emery cloth and wipe it clean. Paint it in an open position and close it only when completely dry. Do not paint weatherstripping. If latex paints are to be used, be sure to buy a high-quality exterior type.—Ed Ziff



Place new unit into opening from the inside of the house. Notch existing jamb bottoms for new threshold if necessary.



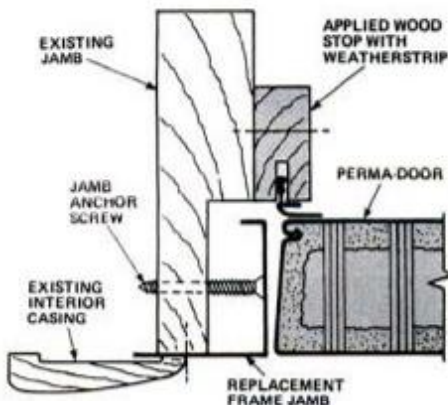
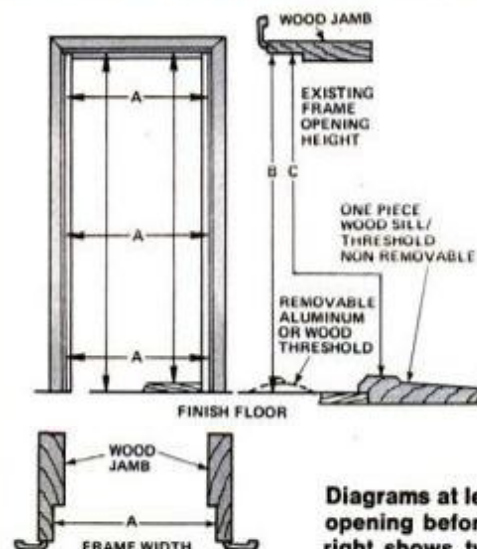
Secure unit to jambs by nailing through pre-drilled holes with 6d underlay nails. Remove retainer straps and open door.



Install jamb anchor screw in pretapped jamb holes. Note: Overtightening screws may cause jambs to bow so be careful.



Measure wood stops with pre-attached weatherstripping for snug, corner-to-corner fit. See text for installation procedure.



Diagrams at left and above show how to measure your door opening before ordering replacement unit. Diagram above right shows typical door and jamb section, installed.

BUILD YOUR OWN KITCHEN CABINETS

(Continued from page 146)

not apply sealer to any parts that will receive glue.

To assemble, glue one side to the base and shelf (Photo 15). Drive in 6d finishing nails to secure. Turn the workpiece over and attach the other side. Add the front and rear cross members, corner braces and the back panel hardboard or luan plywood.

The cabinet door lip can be cut in one step with a shaper. If you don't have that tool, round the front edges with a router and rounding-over bit and finish the edging with the dado cutter on your table saw. To minimize splintering problems at the corners when you're routing and cutting, cut across-the-grain edges first, then cut the two edges that are with the grain. Before routing, fill any voids in plywood edges to keep piloted bits cutting straight.

Assemble the drawer using glue and 1 1/4-in. finishing nails. If you use a drawer-slide assembly other than the one mentioned in the plans, check the manufacturer's required drawer clearance allowances before you build the drawer.

Make the countertop so that it will overhang 1 in. at the front and on exposed sides. Its surface is faced with 1/16-in. plastic laminate. The back-splash is made separately and added to the counter after it is laminated.

First apply plastic laminate to the counter's vertical front edge and back-splash vertical sides. Cut all pieces at least 1/8 in. oversize so they can be trimmed with a flush-trimming router bit. After trimming, bond the laminate to the counter's top and the top edge of the back-splash. Trim.

Once contact between glued surfaces is made, the laminate cannot be shifted without great effort. So use either slipsheets or clean wooden strips to assure accurate alignment. First lay two sheets of kraft paper, lapped 2 in. at the center, over the surface. It won't stick when the cement is no longer tacky. Position the laminate accurately. Then slip out one of the sheets to allow contact to be made at one end. Now the piece will not shift and you can remove the second sheet to complete the bond. Immediately, apply a roller, or a hammer and softwood block, over the entire surface to get uniformly good contact.

Basic construction procedures are the same for the wall cabinet. It is mounted to the wall by screwing through both upper and lower hanging strips into wall studs. Where the wall is hollow, use Molly anchors.

Butting wall or base cabinets can be joined by a pair of long flathead screws extending through the stiles. **PM**

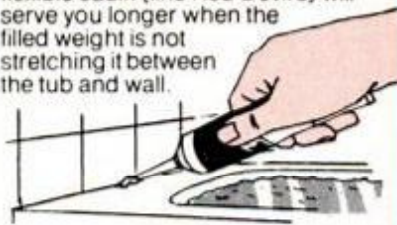
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Home
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Guide

How to pick a home improvement contractor

Beware of contractors who promise a 'special' price for one reason or another. Quality remodeling by a first-class contractor can't be offered at a cut rate.

by Harry Wicks

HOME AND SHOP EDITOR



The fact that homeowners in all 50 states spent more than \$35 billion for home improvements, remodeling and do-it-yourself activities last year is reason enough for the quick-buck boys to make their annual spring move into the home improvement contracting field. The Better Business Bureau repeatedly warns of schemes that are commonly used by the con artists who hope to lure unwary homeowners into signing contracts without giving them a great deal of thought.

A technique frequently used by fraudulent dealers is the so-called "bait-and-switch" angle. For example, a low price is quoted for a particular job, and then—when the salesman has the owner's signature—he advises that the material is either shoddy, unavailable, or won't resist wear when exposed to the elements. The gimmick is to get the client to then agree to convert his original full payment to a down payment on a higher-quality job. The bottom line is that those so hooked eventually wind up with an exorbitant contract.

About projects in general

Make no mistakes about it, your home is a big investment. For most of us it is the single biggest investment we will ever make in our lives. Thus it makes a lot of sense to take care of what we own—to maintain the property in good shape, and to update it as the need to arises.

If your home is properly maintained over the years, it is an almost certain bet that it will increase in value. At the very least, a good maintenance/improvement program will assure that your home maintains its value as inflation continues.

A responsible home improvement contractor will be the first to help you make the necessary choices and decisions to see that you get true value for dollars spent. The fly-by-nighters couldn't care less.

The National Home Improvement Council has a checklist for getting good contractor value:

☐ **Check your needs;** determine which repairs, improvements, and additions are most needed. Establish a priority list of jobs to be done in the order in which you plan to do them. Until the must-do jobs are out of the way, forget about those jobs that are intended to satisfy your personal tastes for luxurious living rather than actual needs.

☐ **Planning your remodeling.** The first step when planning any home improvement is to make a list of exactly what you think you want in the finished job. If you're adding a room, spell out what activities the room will be used for. In some cases, you may have plans for multiple use of the room. A family TV room, for example, can double as a guest bedroom. Or an add-on family room might have a cooktop unit installed in a fireplace wall in order that informal cooking can be done in the room.

What is an estimate? A bid?

There is a marked difference between an estimate and a bid. An estimate is just what the name implies—an educated guess as to what a particular job will cost. A bid, however, is a precise determination of the

amount for which a contractor can perform a particular job. For example, suppose you ask a contractor what it would cost to replace your existing front door with a brand new one. He may quickly reply, "About \$200." That is a rough estimate. If you then decide to proceed, you would lay out the job exactly, including the specification of materials to be used—door, hardware, and so forth. With such concrete facts in hand, the contractor can then proceed to work up a bid for the exact amount of his contract.

Depending upon the materials that you selected for the job, the bid price in this case might be anywhere from \$150 to \$250.

The point is that you should never use an estimate as an ironclad cost-of-project figure. Keep in mind that an estimate is only a ballpark figure intended to help you to make a sound decision as to whether or not to go ahead with a particular job.

Working with a contractor

There are several ways to select a contractor—or a number of contractors—to call in for bidding. The most obvious is recommendation by a friend or neighbor who has had work done by a reputable local contractor; one who is completely satisfied with his work performance. This also gives you the opportunity to inspect the work that the contractor did for your friend.

A quick way to find a number of remodeling contractors in your area is to check the Yellow Pages. But keep in mind that the classified directory only tells you who is available—not who is best.

There are three things you should think about before you select your contractor.

1. His reputation: Ideally, the company you choose will have an unblemished record and be respected for its honesty, workmanship, and delivery record. It should be obvious that you would be wise to steer clear of those contractors who leave behind a string of complaining customers and unfinished jobs.

You can get a line on a builder by checking with the local Better Business Bureau and by talking with neighbors and friends in the business community (i.e., real estate brokers, bankers, lawyers).

2. Credit standing: Ask your prospective contractor the name and branch of his bank so you can check his company's financial standing. An honest business person will not be insulted; in fact, a reputable dealer will be proud of his good credit standing.

(Please turn to page 180)

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30 DAY MONEY BACK GUARANTEE

Home Ideas Guide

PICKING A CONTRACTOR (Continued from page 179)

ing because it indicates his reliability, stability and solvency.

Though you may be embarrassed to ask the contractor these questions, you shouldn't be. Keep in mind, for instance, that you are well checked out whenever you ask the bank for a home improvement loan.

3. Work performance: A reliable contractor will have a list of satisfied customers readily available. Don't be afraid to request this list of names and addresses so that you can inspect his craftsmanship and talk with his customers. If your planned project is a large one, you would be wise to visit at least three similar jobs your prospective contractor has done for others.

Beware of contractors who say that they can't seem to find any customers' names in the immediate area. Be even more wary if they claim that such records are unnecessary and that they don't bother to keep them. Such negative responses should be your cue to dismiss the contractor from further consideration. It's a pretty safe assumption that he's a fast-buck artist on the hustle. You don't want that "fast buck" to be yours.

Competitive bidding

In remodeling work, it's best to get competitive bids on jobs in the \$500-and-up range. You can, of course, request bids on smaller jobs but many contractors aren't that eager for work in the lower price range these days. Some will decline the invitation because they have more attractive opportunities elsewhere, or because they do not have the time or incentive to work up estimates for small jobs.

In fairness to the contractors bidding on a project, make certain that all of them are bidding on exactly the same job. All bidders should be working up their prices from identical sets of drawings and specifications that clearly spell out how the project is to be constructed and with what materials.

My personal experience in the home improvement and building business has led me to conclude that too often a homeowner merely asks the contractors to give him a price without spelling out details. Then, he is usually overwhelmed by a wide range of prices the various contractors submit. As a result, and the homeowner may not realize it, the lowest bid may be based on the lowest-quality materials available. Similarly, the high bidder may have figured upon

using the very best materials which can be substantially higher in cost.

For example, if you are planning a room addition that will have, say, four casement windows, one bidder may choose to install locally-fabricated windows without storms and screens. The bidder on the high end may, from experience, choose a top-of-the-line double or triple glazed window that comes with screening. The latter can cost \$60 to \$80 per window more than the cheapies—and is worth every penny of it.

The point is that unless all contractors' figures are based upon exact and identical criteria, there is no way you can evaluate competitive bids fairly.

The bottom line is that when all bids are in, you may not necessarily go with the lowest bidder. You may have learned in your pre-bid investigations that the low-bidding outfit never meets promised completion dates—or never seems to completely finish the job.

The fact is, based upon reputation and praise from those you have talked with, you might go with the highest bidder in order to best complete your project with a minimum of aggravation.

Get a contract

Though some may justifiably argue that a contract with a home remodeler isn't worth the paper it is printed on, the contractor you choose should present a formal contract for both parties to sign. The job should be fully explained therein, materials clearly spelled out, and dates of completion indicated. Terms of payment should also be detailed. Many contractors split the fee into three payments—the first one is usually up front, at the time of contract signing; the second is after an agreed upon amount of work has been performed, and the final payment after the job is completed and you (the customer) are satisfied.

For more information on working with and selecting home remodelers and contractors, write for these free booklets:

Choosing a Paint Contractor, The National Paint and Coatings Assn., Inc., 1500 Rhode Island Ave., N.W., Wash., D.C. 20005.

How to Start Your Home Improvement Project With the Help of a Reliable Contractor, National Home Improvement Council, Dept. PM-478, 11 East 44th St., New York, NY 10017. It's free, but send a stamped, self-addressed envelope. **PM**

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11" Bandsaw

This is the only 11" bandsaw available that offers unlimited cut-off capacity on workpieces up to 3 7/8" wide, thanks to our exclusive reversible blade guides that let you twist the blade to a 30° angle from the frame. Our patented self-aligning pulley design eliminates the need for continual tracking adjustments... and setting the blade tension is as simple as matching the indicator on the tension gauge with the width blade you are using. There's no guesswork!



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The Shopsmith Jointer is the *only* jointer offering individual blade leveling screws and a unique blade clamping wedge that eliminate the need for match-grinding all three blades to the same exact size. Now you can sharpen your *own* blades and make leveling adjustments while the blades are on the machine. The Shopsmith Jointer has the longest table surface (28") and the longest fence in its class. The infeed table extends beyond the outfeed table for added support during rabbeting operations.



6" Belt Sander

With the Shopsmith Belt Sander, tension adjustments are automatic. Our exclusive tensioning knob releases the belt quickly for removal and returns to the proper setting **AUTOMATICALLY**. Tracking adjustments are also virtually automatic, thanks to Shopsmith's high crown drum design. The working table may be used across the belt, parallel to it on either side, or at any angle you decide! A single knob control lets you tilt the table from 20° toward the belt to a full 45° away from it!



18" Jigsaw

The exclusive built-in blower directs a steady flow of air on the cutting line at all times to keep it free of sawdust. Another benefit of this feature is blade cooling, an important consideration when cutting plastics or metal. The Shopsmith Jigsaw will easily accept fine jeweler's saws which provide the thin, hair-line cuts so vital to the art of marquetry. By loosening a single locking screw, the tubular arm can be easily removed, converting the Jigsaw into a Sabre Saw with **UNLIMITED** capacity!

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Here's a roundup of items packed with potential to enhance your surroundings, save you money in the long run or simply add to your living enjoyment.

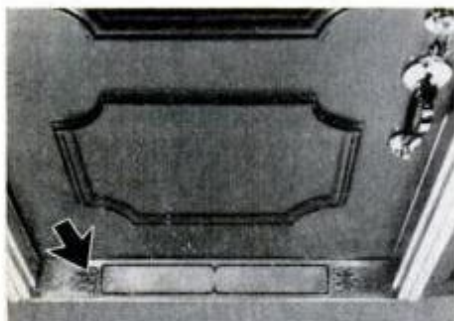


A practical approach to cutting heat loss (by as much as 60 percent) through existing walls is to use Climate Guard insulation board. A ½-in. foam-plastic core reinforced with fiberglass, it has an aluminum foil cover that adds reflective insulating value. It can be used with standard or insulated aluminum siding and other sidings; nail it in place, then nail on the siding. A standard 4x8-ft., 4-in.-thick sheet costs approximately \$9. It's made by Reynolds Metals Co., Richmond, Va. 23261.



Handsome, rugged-looking ¼-in. paneling is well suited to informal, low-maintenance areas of your home. This knotty pine print on plywood with random-spaced grooves and rustic markings is reminiscent of old tongue-and-groove boards that are much in demand today. The Pineview design panels come in gray, dark, medium or light wood shades. Cost is \$8 per 4x8-ft. panel. Champion Building Products, 1 Landmark Sq., Stamford, Conn. 06921.

Pride in your home shows itself in the finishing details, such as this solid brass doorsill. It's better than a welcome mat for greeting guests. The decorative sill by Pease Ever-Strait fits all door systems that company has ever made and simply attaches over the regular metal sill that comes with the door. It installs with three screws along each side. Cost is \$35 from Pease, Fairfield, Ohio 45023.



13 new products for improving your home

This new Mayfield sink can be used to replace an existing sink with older-type metal hudee rim. It measures 25x22 in. and is self-rimming so you can install it conveniently as a replacement sink without having to redo the countertop. Of durable enameled cast iron, the Mayfield is available in nine colors and white at \$85 up. Kohler Co., Kohler, Wis. 53044, sells it through plumbing supply and building supply centers.



The Provider is a free-standing fireplace that conserves energy and acts as an auxiliary heat source. A built-in fan circulates air through the heating chamber and back into the room through side louvers to provide rapid room heating. An attachment that draws combustion air from outside the home for added energy savings comes in kit form for \$44. Fireplace is from \$660, by Preway, Inc., Wisconsin Rapids, Wis. 54494.



Small but mighty, the new 5000-BTU "high efficiency" room air conditioner by Frigidaire has an energy efficiency ratio (EER) of 8.8—as high a rating as there is for air conditioners of this size, according to the manufacturer. Its energy-saving control turns the compressor and fan off when a preset temperature is reached. Cost is about \$275, by Frigidaire, Dayton, Ohio 45442.

(Please turn to page 184)

LOOKING FOR IDEAS ON HUNTING, FISHING, CAMPING, BUILDING, TOOLS, ETC.? CHECK THESE LISTINGS. THEN USE THE COUPON BELOW.

WORTH WRITING FOR

800 Tips for redwood paneling

A detailed step-by-step brochure from the California Redwood Association tells you how to panel any room with redwood lumber. Photos and diagrams explain vertical, horizontal and diagonal paneling, plus there's information on materials, tools and finishing. 20¢.

801 Shocked by your electric bills?

A valuable booklet from the Edison Electric Institute gives over 100 energy-saving tips to cut your electricity costs. It tells how to reduce your electricity usage in home heating, cooling, cooking, lighting, laundering and refrigeration. Free.

802 Greenhouses for green thumbs

Gardening year round is easy when you can tend to your plants in a greenhouse. A big brochure from the Texas Greenhouse Company illustrates their wide selection of custom or standard greenhouses—there's a shape and size to fit your gardening needs. Also includes information on an array of greenhouse accessories. Free.

803 Guide to the right finish

Here's a brochure describing the Flecto plastic finishes for interior and exterior uses—wood stains, plastic enamel, sealers, marine finishes and more. Includes information on surface preparation, application, uses and clean up for all. Free.

804 Stopping the leaks

If your brick, concrete, cinder block or stucco walls let in moisture, United Gilsomite Laboratories has a solution. A 16-page pamphlet explains how to waterproof interior or exterior porous masonry walls to provide a barrier against seepage. 25¢.

805 Generating some power

Honda offers a pamphlet with all the specs for their portable generators, from a compact 400-watt model to a heavy-duty 5000-watt workshop—ideal for camping, the workshop or emergency use. Also includes information on the Honda outboard engine and power tillers. Free.

806 Discover unusual tools

If you can't find that special little tool you've been looking all over for, you'll find it here. National Camera's Flasher catalog is packed with thousands of unique precision tools for the workshop. Free.

807 Plug the gaps

Energy-wasting gaps around doors and windows can raise your fuel costs. This booklet from Macklanburg-Duncan tells how to find and seal them. Includes tips to lower your fuel bills. 25¢.

808 Books for the do-it-yourselfer

An illustrated 64-page catalog from Audel, lists their concise, easy-to-understand books for the homeowner, craftsman or handyman. You'll find handy reference books covering subjects from auto repair to building construction. Free.

809 Facts about humidity

Air that's low in humidity can damage furniture and walls, make you uncomfortable and cause many other annoying problems. An

informative pamphlet from Research Products explains how to find the proper indoor humidity, how to choose a humidifier and other humidification facts. Free.

810 Rockwell 1978 Buyers' Guide

A full-color, 56-page booklet is your guide to Rockwell's power tools and accessories for 1978. All their tools are described with complete specifications and photos. 50¢.

811 Easy sealing

Do-it-yourself fix-up jobs are made easier with Stay-Tite Products. Here's information on their complete line of products that seal, caulk or patch driveways, roofs, walls and windows. Free.

812 Reference guide to power lawn equipment

International Harvester's big 20-page brochure is a complete guide to all their power lawn products, from garden tractors and riding mowers to the walk-behind mowers. Also includes information on the full line of shredders, tillers and snow blowers. Free.

813 Get ready for spring fix-up

Woodhill Chemical offers full-color leaflets to give you a head start on all those household repair and clean-up projects. Loads of hints to make the jobs easier. Free.

814 Tools, tools and more tools

All 196 pages of the U.S. General Supply Corp. catalog are filled with top-name tools and handyman supplies—6,000 of them! At low prices, too. \$1.00 (refundable on first order).

815 Unique stationary power tools

Shopsmith, Inc. offers a full-color, 12-page brochure describing their bandsaw, jointer, belt sander and jigsaw. They're designed for accurate, trouble-free performance. Free.

816 A super way to sand

The new industrial strength power tool abrasives from Carborundum are cloth backed and resin bonded for longer wear without tearing or clogging. They're available in belts, discs and sheets. Get all the facts in a free pamphlet.

817 Keep your home cool

Home cooling costs can be reduced by using a ventilator fan that cools your home with a gentle breeze. A pamphlet from Cool Attic Corp. gives details on how it works, plus the simple installation instructions. 25¢.

818 Start your own siding dealership

Do you want to become a full or part-time siding dealer? Aluminum Industries of Arkansas will send you all the material you need to begin selling their do-it-yourself aluminum, steel or vinyl siding. Free information package.

819 Texture your ceiling

An illustrated pamphlet from Gold Bond Building Products gives easy, step-by-step instructions for applying a textured ceiling. It snaps up drab ceilings and covers blemishes and hairline cracks. Free.

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It's no wonder that for over 20 years, do-it-yourselfers have recognized the BernzOmatic Jet Torch as the first and best torch for a variety of home repairs.

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BERNZOMATIC CORPORATION, ROCHESTER, N.Y.

13 NEW PRODUCTS (Continued from page 182)



This double wall oven has a microwave unit on top and a conventional oven below. The microwave has a memory system, special automatic temperature control and electronic touch control. The self-cleaning lower oven features bronze glass door, a clock and automatic oven controls. The Micromatic model 880 oven costs \$1100 from Litton, 1405 Xenium Lane No., Minneapolis, Minn. 55441.

The Ever-Closer self-closing door hinge—\$15 from Pease Ever-Strait, Fairfield, Ohio 45023—is designed to fit all Pease doors (adaptation to other makes will require a professional carpenter). A boon for adults and children who forget to close doors, the hardware has no protruding parts.



Decorative redwood strips come rough-sanded on one side, smooth-sanded on the other to give you a choice—or mixture—of textures. The strips, packaged in 1 to 4-ft lengths to cover a 33-sq.-ft. area can be used to make designs such as sunbursts and pyramids with mirror tile, brick and other materials. At lumberyards, \$18 per package. Pope and Talbot, Inc., 1700 S.W. 4th Ave., Portland, Ore. 97207.

The Hot One, II.



The brand-new BernzOmatic Jet Torch II, the most versatile propane torch you can buy.

It outperforms any other propane torch! The BernzOmatic Jet Torch II burns with heat so highly concentrated, it can actually braze-weld metal. It can handle literally hundreds of do-it-yourself jobs requiring strong, weld-like repairs. And because the BernzOmatic Jet Torch II concentrates the heat, it can do them much faster, too.

Look at the home repair jobs it can do—and the time and money it can save you in replacement costs. Repair garden tools, lawn mowers, toys, fences and metal furniture. Use it for metal sculpture, auto body work, metal bending, and many other jobs.

See the BernzOmatic Jet Torch II at your dealer's soon.



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Ranchwood paneling from Masonite Corp. has the appearance of aged, rough-sawn barnwood. Its hardy good looks are at home in den, family or recreation room setting. To add to its dimensional textured effect, the pre-finished hardboard paneling features simulated planks of varying widths and color intensity. Planks are separated by dark grooves, have authentic-looking splits, knots and cracks. Panels are available in light or dark Ranchwood. A 4x8 ft. 1/4-in.-thick panel costs \$14.

The Electri-saver under-counter dishwasher can save up to 30 percent of the electricity usually used in a normal cycle, and 40 percent in the quick-wash cycle. A triple-wash cycle cleans heavily soiled pots and pans, as well as crusty casseroles. The upper rack is adjustable to provide clearance for large items on either upper or lower rack. Door panels and base panels come in a color choice of white, gold, green and copper, and can be replaced with other decorative material. Cost of this top-line model is \$480 from Frigidaire, Dayton, Ohio 45442.



Problems with old metal doors are solved in this replacement aluminum sliding glass door. The frame is insulated and glass is double-glazed with a 1/2-in. air space to minimize heat loss. Door is built to open and close smoothly. The frame is sized in 6- and 8-ft. widths to replace most older doors. A 6-ft.-wide door costs \$495 from Continental Aluminum Products Co., Box 596, McHenry, Ill. 60050.



The sun's energy comes to our aid once again (and fuel resources are conserved) in the Fedders solar-assisted heat pump system. The system combines an energy-efficient heat pump with a solar hydronic heating system. Components are from front left, the solar heating coil, the air handler and pump air conditioner, and the double-glazed solar collector in the back. The system also includes a control panel and thermal storage tank. The collector gets energy from the sun and uses it to heat water in the storage tank. From this point on, the system works as a conventional fan-coil hot water system. Fedders Corp., Edison, N.J. 08817.

(Please turn to page 186)



The Hottest One.

The unique BernzOmatic Oxygen Cutting/Welding Torch, the first professional-style welding rig for do-it-yourselfers.

It's the ultimate torch! Like a professional rig, the new BernzOmatic Oxygen Cutting/Welding Torch can cut, weld, braze and solder, yet is much handier and easier to use. It's totally portable and fits easily into tight spots not easily accessible with a professional rig. It's even styled like a professional rig and uses real oxygen and either propane or Mapp gas (Reg. trademark Airco, Inc.) supplied in separate cylinders.

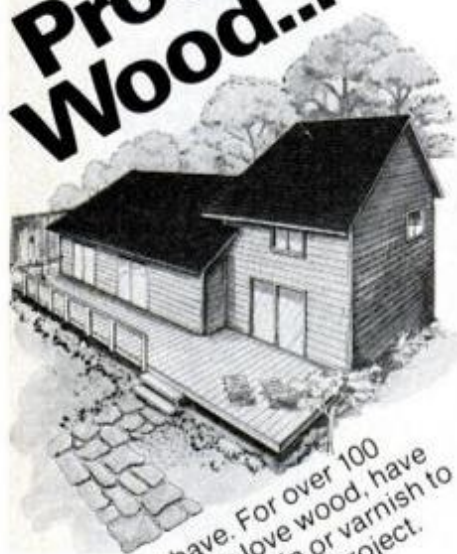
What's more, you can use it for all types of indoor and outdoor household repairs, from plumbing to jewelry-making, and for auto body work and van conversion.

See the amazing BernzOmatic Oxygen Cutting/Welding Torch at your dealer's soon.



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We always have. For over 100 years, people, who love wood, have found a McCloskey stain or varnish to satisfy their wood finishing project. Inside or outside.

And maintaining the natural beauty and texture of wood outdoors is something McCloskey products do best. We have perfected the and stains that withstand the weathering effects of moisture, sun and temperature changes to give lasting protection to any exterior wood surface. All go on easily.

For a free booklet on wood finishing tips, write McCloskey Varnish Co., Dept. F, 7600 State Road, Philadelphia, PA. 19136.

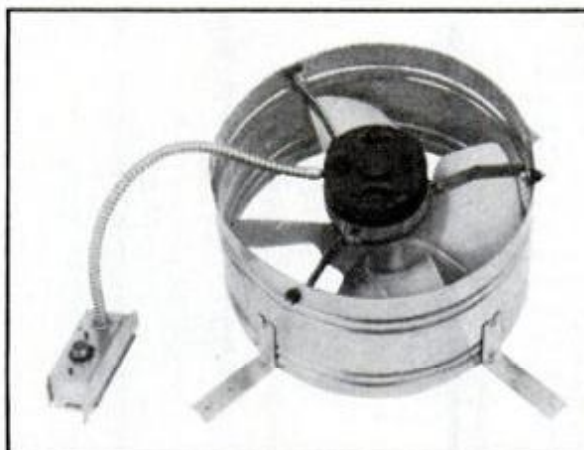


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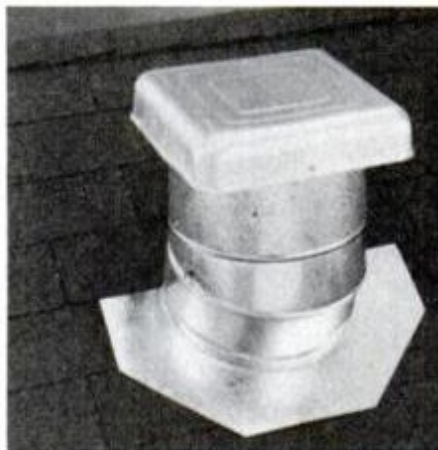
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13 NEW PRODUCTS
(Continued from page 185)

The versatility of Jenn-Air's 4800 series grill-range-oven combination makes routine meal preparation a pleasurable experience. A grill element lets you enjoy char-broiling inside year round. A built-in surface ventilation system eliminates the need for a range hood. You can cook on regular cooking elements or ceramic cooking surfaces. Accessories include rotisserie, shish-kebab rack, griddle and french-fryer. The oven cooks by radiant heat or by convection with a power-driven stream of heated air. It's priced at \$896 by Jenn-Air Corp., 3035 Shadeland, Indianapolis, Ind. 46226.



The gable-mounted, electric attic ventilator (above) can cool your attic and therefore cut down on your airconditioning energy consumption. According to the maker, this can result in 30 percent or more energy savings. The ventilator fits invisibly behind a wood louver or the automatic shutter (right) which opens when the ventilator starts. Ventilator is \$65, automatic shutter is \$32 from Nautilus Industries, Box 159, Hartford, Wis. 53027.



If you have a wind-operated, 12-in. standard turbine ventilator, you can upgrade to a power attic ventilator easily with Leslie-Locke's power attic vent. The power vent can be used with the existing turbine base to provide improved ventilation. An automatic thermostat activates the unit when attic temperatures rise, so—properly installed—the vent can provide about one complete change of attic air every six minutes depending on attic size. Temperature range is 70° to 130°F. PTR-12 power ventilator unit is \$68 from Leslie-Locke, 2872 West Market St., Akron, Ohio 44313.

Visitors can read your house number on the darkest night when you have Numa-Glo Address-Lite. Light is made of molded white Plexiglas. It requires only 3 watts of electricity to operate, at a cost of less than ½-cent a day. The low-voltage light connects to a doorbell button with two wires. You can read the 16¼ x 4½-in. unit from 150 yds. \$20 from Residential Products Co., Ann Arbor, Mich.



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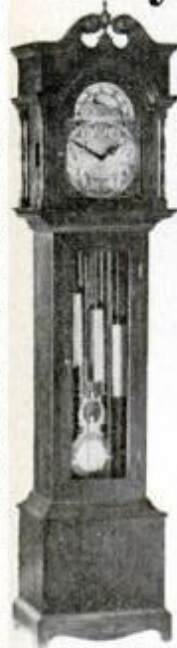
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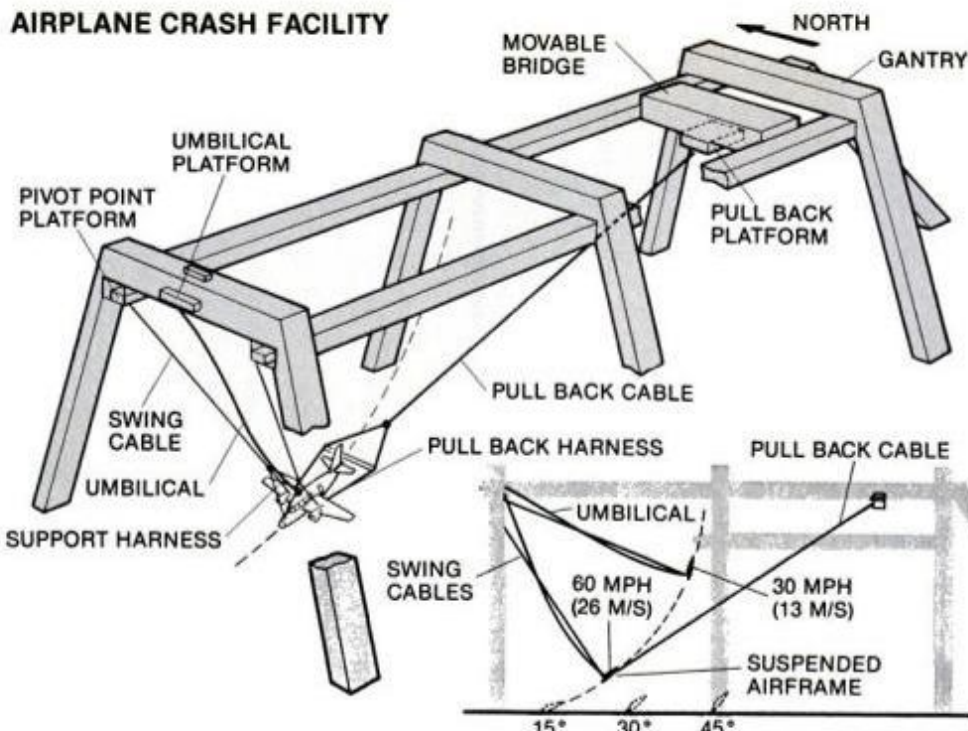
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AIRPLANE CRASH FACILITY



TARGET: A SAFER PLANE TO CRASH IN (Continued from page 86)

mounted on the instrument panel can see over him and record movements of "passengers" behind him.

The doomed aircraft are also personalized with fetching titles painted on their cowls, such as *Dragon de Tail* (for a nose-up crash test), *Injun Failure*, *Pile-it Error* and *Lead Zeppelin*, to name a few. Most labels have some in-house significance for the crews. *Lead Zeppelin*, for instance, had its engines, tail surfaces and other components unnecessary to the test replaced by lead weights.

Lives justify cost

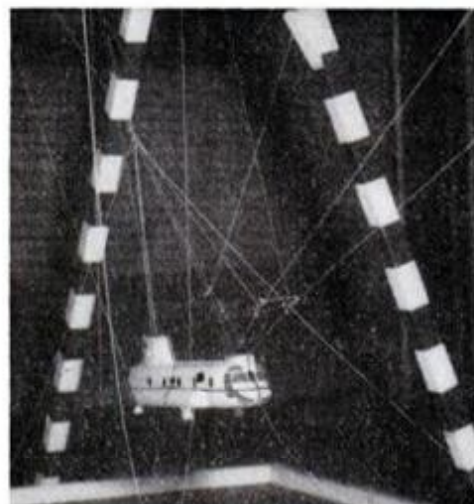
How do you justify crashing dozens of brand-new, quarter-million-dollar airplanes without batting an eye? For years, on-going federal crash research has been limited largely to static tests of structural materials—with a few simulated crashes of old airframes thrown in. In the mid-50s, engineers of the then National Advisory Committee for Aeronautics (NACA) catapulted some surplus C-46 transports into dirt embankments at 100 mph, using dummy passengers.

Out of these experiments came a proposed design for a "crash-safe" transport. Its most dramatic features involved backward-facing seats with sturdier anchorage to stronger deck framing, restraining devices that included an automatic inflatable nylon bag fitted behind each seat-back, and a shoulder harness for each passenger. Proposals even were made for detachable cabin pods that would parachute to earth. Airline executives shuddered and turned a cold shoulder.

Since then, however, some 3575 lives have been lost due to impact in crashes of U.S. air carriers and about 925 more due to fire. Of the latter, 325 died in a single Pan Am jumbo jet last year when it was hit by a KLM 747 on a Canary Island runway. (For a report on fire-safe aircraft research, see page 87).

Such statistics alone might justify a program. But what really got the Langley show off the ground was an "act of God." In 1972, flood waters from Hurricane Agnes inundated Piper Aviation's factory in Lock Haven, Pa., subjecting 32 new twin-engine Navajo executive planes to a devastating mud bath. The resulting damage forced federal inspectors to declare all 32 aircraft unflyable. Hence, NASA and FAA scientists

(Please turn to page 190)



Critical tests are worked out first on a model of NASA facility. Here, Army's CH-47 gets mini drop test before real one.



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were able to buy them up at scrap prices, making possible the first large crash-worthiness study using full-scale planes in real crashes.

Can information obtained from busting up these private aircraft be applied to large commercial jets? You can't presume to make instant conversions of all factors, Dr. Thomson points out. But he and his team leaders, Victor Vaughan, in charge of facility operations, and Emilio Alfaro-Bou, research engineer, acknowledge that many surprising things they have learned can be applied to any plane and could increase the chances of passenger survival in a crash.

Surprising new knowledge

Since tests began in 1974, some serious misconceptions have been rudely blasted. First to go was the idea that the slam of first impact in a nose-down crash was the big "bang" that killed and maimed.

"By the second or third test," says Dr. Thomson, "we got the message loud and clear that there are two major impacts. And the second may be far more damaging than the first—in an unsuspected direction: vertical!"

Earlier tests had led researchers to assume that in a nose-first crash, nearly all the force of impact is rammed back instantly through the structure and transmitted directly to seats and passengers, which tear loose in "free flight" around the cabin. The Langley studies showed that when the nose hit at angles of 25° or less it crumpled and absorbed as much as 50 percent of the initial impact shock. But, as the crash progressed, the fuselage—following the nose—buckled and, like a curling bull whip, snapped down to the ground with a resounding wallop of 50 Gs or more.

"The occurrence of many spinal injuries was explained," says Emilio Alfaro-Bou. It also explained why seat legs so often collapse, and why seats pitch outward from the center aisle (it's the ground coming up in the middle), sliding passengers out from under harnesses.

The photo sequence of Test No. 6 (page 84) revealed dramatically to scientists how a nose-down crash progresses like a curling wave along the fuselage top. The traveling crimp in the cabin roof, moving back, battered the heads of forward passengers in a split second. Then, as the rear end of the fuselage whipped down, the cabin reformed

(Please turn to page 192)

PROJECT 'BURN' FOR FIRE-SAFE PLANES (Continued from page 87)

the cabin, then systematically ignited and monitored by computerized instrumentation to indicate probable survivability factors in a real crash.

"Many people contend that fuel fire is the dominant hazard in a crash-fire accident," says NAFEC. "However, this appears unlikely in view of facts regarding toxic gases gained from autopsies done on victims of crashes."

In a 1972 crash at Chicago, a DC-9 and Convair 880 collided on the ground in heavy weather. The DC-9, attempting takeoff, hit the 880 and caught fire. Luckily, 35 of the 45 on board escaped—but 10 didn't. Later, lethal amounts of hydrogen cyanide, apparently produced by smoldering synthetic materials, were found in the bloodstreams of the 10 victims. But surprisingly, their bodies

er factors involved in creating more crash-safe aircraft are being explored:

■ **Improved emergency lighting.** Poor cabin illumination has resulted in passengers' inability to locate emergency exits quickly. Better lighting is expected to reduce panic and speed escape.

■ **Getting smoke and heat out of a cabin.** A well-vented cabin would give passengers more time to exit safely.

■ **Determining how long it takes a fire burning outside an aircraft to enter the cabin.** NAFEC research indicates that intense fire will penetrate an airliner's skin in 40 to 90 seconds. The C-133 tests are expected to improve fire resistance of jumbo jets through the hardening of their fuselages.

■ **Automatic water-fog dispensers—** somewhat like ceiling sprinklers used



Research at NAFEC includes impact tests of fuel tanks and "wet" wings (containing fuel cells) in efforts to determine "splashability" of different types of jet fuel. Here, a tank full of fuel explodes violently as it is catapulted at better than 100 knots against a hillside. Researchers are endeavoring to develop containment to prevent the spread of fuel and flame.

remained untouched by actual fire.

Dr. Joseph Spurgeon, an analytical chemist at NAFEC, is attempting to zero in on the amounts of lethally toxic gases released by supposedly non-flammable aircraft materials that don't burn but do smolder—perhaps an even greater killer than direct fire or impact force. The 1974 crash of a Pan Am 707 in American Samoa is a bitter example of this curious and frightful phenomenon. The jet, attempting a nighttime instrument approach, fell short of the runway. Of its 101 passengers and crew, only four survived. Yet its cabin was intact after the crash and only one person was believed to have received potentially fatal impact injuries. Fire and/or toxic fumes killed the others.

Data derived from the C-133 tests at NAFEC will probably result in an FAA standard requiring the aircraft industry to find and use cabin materials that won't give off toxic fumes in a fire. The "burnable" C-133 is elaborately festooned with sophisticated sensors to detect the effects of fire under a variety of crash conditions. Two hundred thermocouples measure air and surface temperatures; 10 heat-flux transducers clock heat flow through the aircraft body; laser photometers record smoke-density and travel patterns. Oth-

er factors involved in creating more crash-safe aircraft are being explored: it could help to cool it down and slow its progress, giving occupants time to get out. But there are problems. The immense amount of water required could impose intolerable weight on an aircraft's load capacity, making the scheme impractical. An alternative idea is to use plug-in fittings that would enable firefighters to insert high-pressure spray hoses into the aircraft from the outside. An obvious disadvantage is that this would be useful only at airports having the proper facilities—it would be of no help in a remote-area crash. One answer may lie in self-sealing, explosion-proof fuel tanks—similar to those now used in military aircraft and racing cars—to prevent the spread of fuel and resulting fire.

■ **Modification of jet fuel to make it less explosive.** Present jet fuel sprays out in a fine, easily ignited mist when a tank is ruptured. A British additive causes spewing fuel to form large droplets much less prone to explosive ignition.

Will you ever be safe from the fear-some effects of killer crash fires? Perhaps not totally. But—thanks to extensive research projects like those at NAFEC—your chances are getting better and better every day.

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SAFER PLANE TO CRASH IN

(Continued from page 190)

itself, looking pretty much as it had before the crash.

"There is no way," says Bob Thomson, "that crash 'detectives' investigating such wreckage later could even remotely guess what happened to that plane during the split-second interval of double impact."

Wing absorbs impact

More input on vertical impact phenomena was obtained at Langley during a drop test of a 30,000-pound CH47 helicopter for the Army, along with their own fuselage section drops to study deformation of framing members and the transmission of G-forces to seats and passengers (photo sequence, page 85).

Among other revealing experiments was Test No. 9, the "Side-winder"—a plane that hit the ground in a "roll" attitude, port wing low. As the wingtip hit, it curled up (photos, page 86), crumpling progressively and absorbing more than half the energy of the plummeting craft before the end of the slide-out. "Cabin integrity remained intact," recalls Emilio Alfaro-Bou. "The dummy passengers came through virtually unscathed. Moral: If you must crash, do it in a light-plane on a concrete surface at about a 15° flight path, port wing low."

Obviously there never can be a totally crash-safe plane. Langley researchers have limited their work largely to "survivable" crashes in which forces imposed are moderate and the cabin volume remains essentially intact. Few tests have been run with crash angles steeper than 25°. In one run at 45°, the cabin was destroyed. Another steep impact test, run at Langley for the FAA, involved a high-wing monoplane that crashed into 4 feet of soil spread and compacted on the apron. Instead of the earth cushioning the impact, the nose of the craft dug into it and stopped dead at the point of impact. The plane folded like an accordion and flipped over—totalled.

But out of all this has come a flood of data for the computers to chew on. Already they have begun to spew out design concepts for better survival rates in crashes.

Dwight McSmith, an operations group leader involved in seat design, can show you a variety of new seat configurations that will soak up G-forces as they collapse. One shock-absorbing device uses 1/10th-inch, high-strength stainless-steel music wire running between two roller bars that put a traveling U-bend in it as it goes by (diagram, page 77).

In one foot of distance, it will absorb 20 or more Gs of impact force. The unit fits in the back of a seat, anchored to overhead framing for vertical loads—or in a tube running diagonally between back and front legs for forward collapse. Another absorber involves a frangible metal honeycomb cylinder designed to collapse under specific loading forces.

The favorite seat design at Langley, called "the rocking chair," rotates on a horizontal axis as it falls forward and downward under load. The passenger's knees are a pivot point; they remain at the same place in space as the seat collapses, instead of being jammed forward into the hard metal of the seat ahead.

"The energy input pulse from first impact upsets the seat system," McSmith explains. "In a 60-mph bird, the second impact a tenth of a second later triggers controlled collapse, as the passenger rotates to a knees-up, head-down position." The human body, he points out, can withstand almost twice as much vertical impact in that position as it can along the spine.

Similar "controlled collapse" principles apply to the airframe. Researchers presently are shooting for intentionally "crushable" components that soak up the G-forces of a crash so passengers are subjected to more tolerable loads.

"The impact load in a nose-down crash is transported right through the floor beam," notes Thomson. "So crushable beams are the answer. We're still testing materials for weight, thickness and so on."

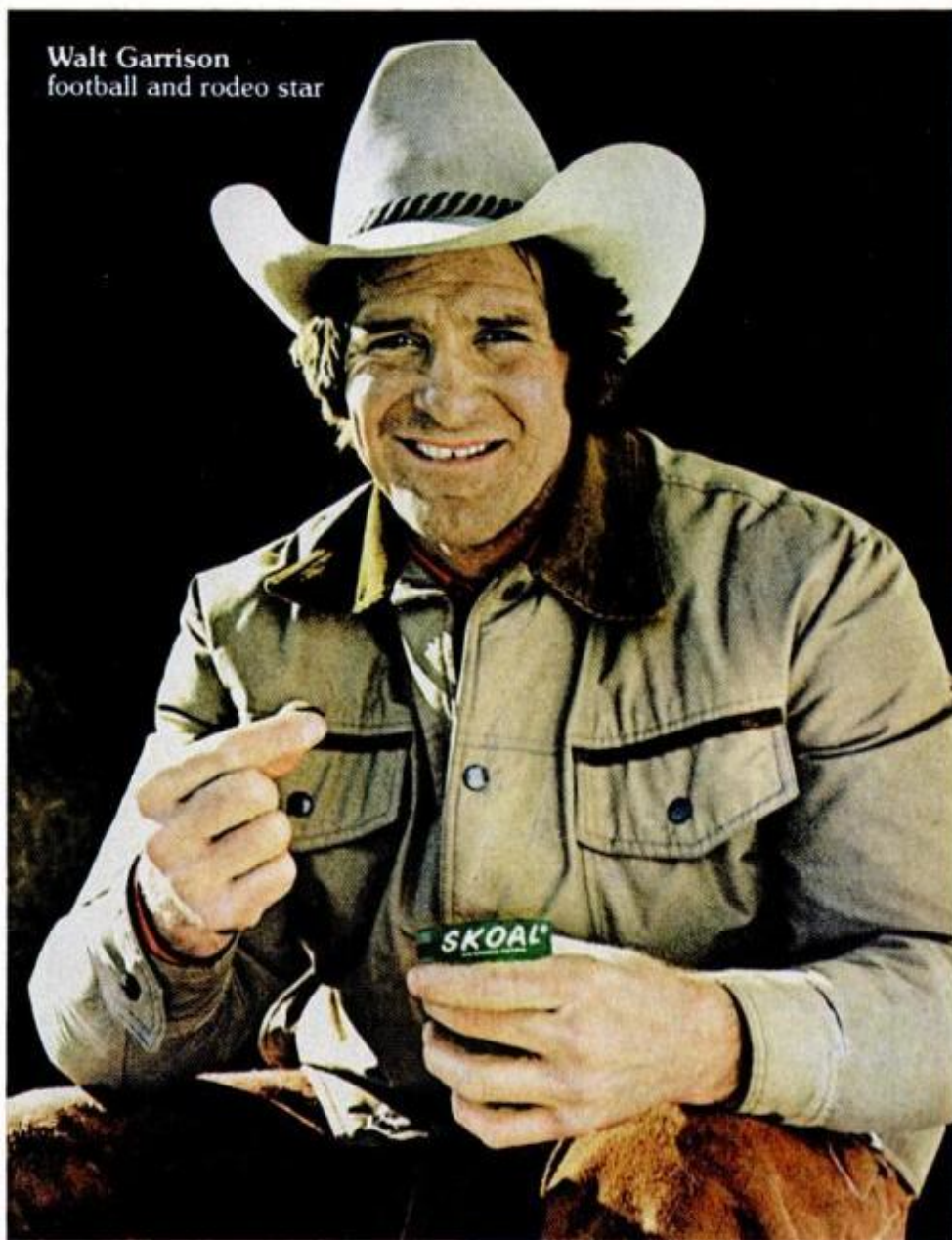
Crushable I-beam

Already they've made half a dozen simplified specimens of crushable designs for testing this year. One unique system (diagram, page 86) uses an I-beam configuration in which a stubby center spine on the lower flange fits into a slotted spine on the upper flange. On vertical impact, the two sides of the upper spine press down against the lower flange and curl up in energy-absorbing failure. "This year," says Dr. Thomson, "we hope to evaluate the performance of the different concepts, choose a promising candidate, make a subfloor for an aircraft and test it in a crash comparison with a standard deck."

How soon will you see planes you can more safely crash in? No one at Langley can say for sure, but one thing is certain: That "act of God" that produced 32 flood-ravaged aircraft to help speed up crash-safety research may ultimately prove to be an act of mercy of incalculable value in the quest to save lives.

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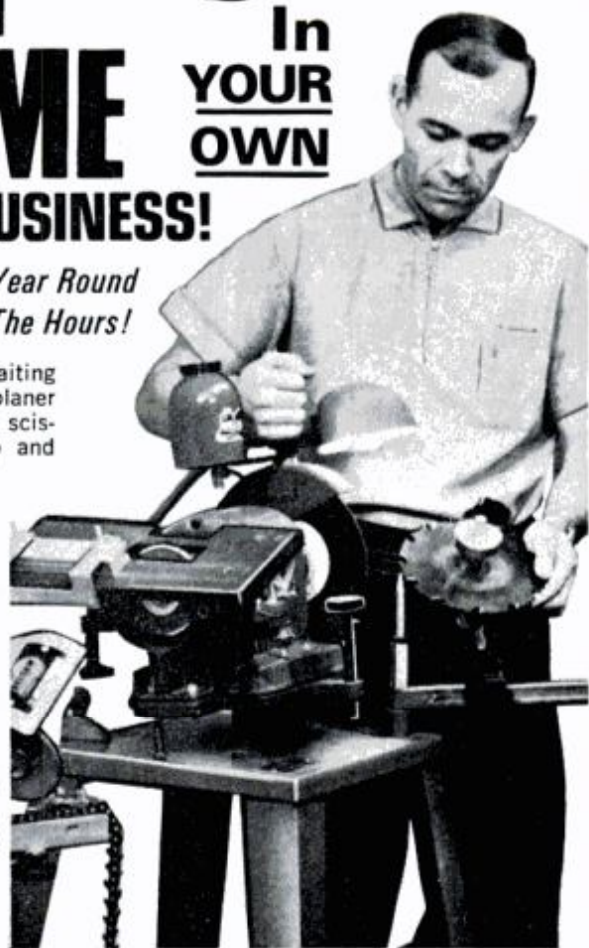
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5 KITCHEN STORAGE PROJECTS

(Continued from page 115)

and brads and sand all parts smooth. Dust and finish with spray enamel. Cut four 1-in. lengths of 1/2-in. dowel for the pivot rods and assemble shelves into the frame. To do it, insert one dowel and hammer it flush with the outside. Mount rack on a dowel and push it against the frame side. Then align the dowel with the other hole and tap in a second dowel until it enters the hole in the other end of the shelf. Repeat for second shelf.

4. Tableware caddy

The fabric support section must be sewn for this project, but you can start by cutting plywood sides to shape and bore holes for the dowels as shown. Note that the holes for the larger-size dowels are drilled through, while the 3/8-inchers are bored 3/4 in. deep. This permits easy removal of the fabric when it needs washing.

Assemble 3/8-in. dowels and sides using white glue. Check the 3/4-in. dowels for fit in the holes and sand slightly, if necessary, for easy removal. Sand and dust all parts; finish with stain and two coats of urethane varnish.

Cut and sew the fabric to size. To hold dowels at both ends, measure back about 2 7/8-in. from each end, fold over and sew a hem. Push the first 3/4-in. dowel through a side hole, then the sleeve and finally through the hole in the other side. Weave fabric through the dowels and repeat installation of the 3/4-in. dowel at the other end.

5. Cleaning supplies tote box

Ours is sized to suit small containers of cleaners; for larger cans and bottles, simply adjust the dimensions, but make certain that you don't alter the size given for the paper towel holder.

Cut all plywood pieces. Then, using clamps, sandwich the three vertical pieces together—with the center section at the correct height in relation to the sides. Bore through the three pieces at one time so all dowel-holding holes will be aligned. Round off corners as shown, sand and dust all parts and cut dowels to length.

To assemble box, use white glue plus 4d finishing nails at all plywood-to-plywood joints. Apply veneer tape to all edges and finish the unit with a color stain—that is, apply an enamel, wipe it off after several minutes and apply two coats of urethane varnish.

PM

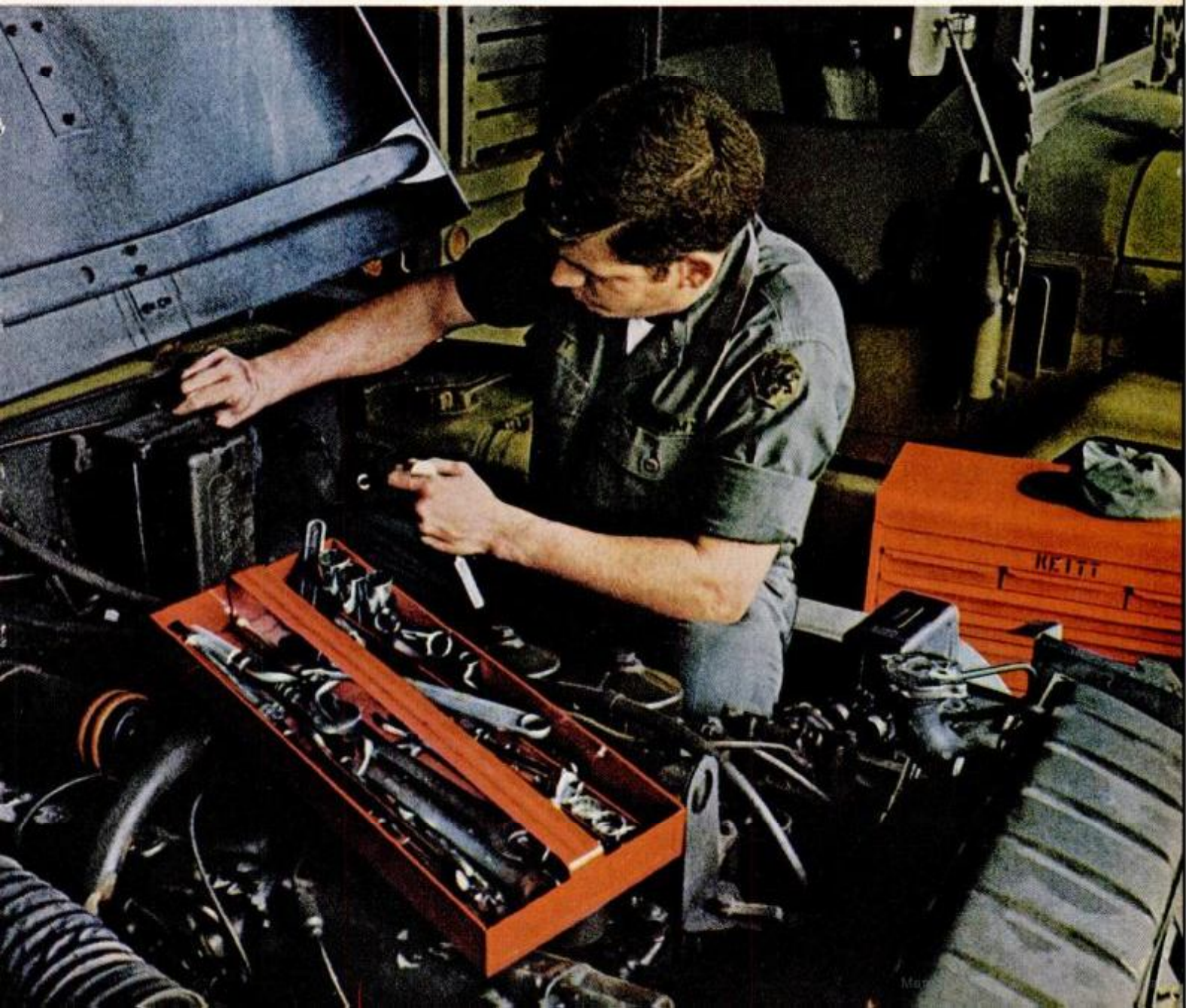
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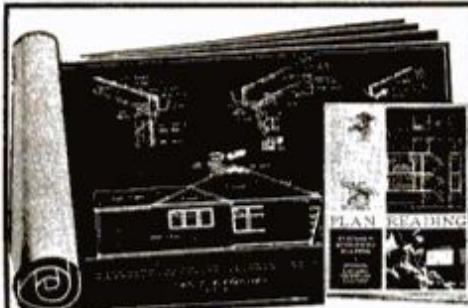
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HOW OILMEN ARE LAUNCHING SUPER RIG

(Continued from page 91)

one thing. But what do you do when you have a structure that's 380 by 400 feet in plan, is 175 feet high, weighs 14,000 tons—and you want to tow it down a Louisiana bayou that's only 14 feet deep?

Answer: Spread the load. Get yourself a barge that's wide and long enough to permit a calculated draft of just under 14 feet. But because a barge that big doesn't exist, it must be created by extending an existing barge to 450 feet in length—a length that will give enough flotation when the gigantic base section is slid onto the barge.

Once on site, the launch barge is eased between two exactly positioned 500-ton derrick barges. From a derrick aboard each barge, wire-rope cables, 3½ inches in diameter, are strung to the waiting base section. Surrounding the base and attached to it is a "skirt" of 24 piling-acceptance sleeves that are 8 feet in diameter. These sleeves are topped with a "cowcatcher" arrangement that will eventually accept the 7-foot-diameter "pins."

But right now the sleeves are capped top and bottom. Water is pumped in to a predetermined level, calculated to develop a slight negative buoyancy when the base is launched. Pumping water in or out of these sleeves will control their attitude angle and rate of descent.

Everyone's astonished

At precisely 2:15 on a bright and quiet afternoon last July 25th, one end of the launch barge was flooded, putting it down by the head 3°. At 2:59, hydraulic pushers nudged the base section. It slid into the water at 3:00 o'clock with little splash and came to rest suspended from the derrick cables with 30 feet above the water and 145 beneath.

The next day, the base was carefully lowered to the bottom as a computer unemotionally listened to the sea-bottom beeper and sweaty-palmed engineers watched TV screens. The engineers controlled the giant derrick winches to adjust the base position to computer figures.

After 36 hours, the base rested in 1025 feet of water and 10 feet of mud. As undersea telemetry flashed in, everyone was astonished. With an incredibly fine tolerance of only 100 feet, engineers had dropped the giant structure to within 20 feet of target center. With a tolerance of just 5° in compass orientation, Cognac's feet are only 1° off. With an amazing level tolerance of only 1°, the 26.6-million-cubic-foot base is

only 1/10th of 1° off level. There was no need to touch the structure's hydraulic jacks, preadjusted at the surface.

But the joy of the successful launch doesn't last long. Now comes another job requiring new skills and techniques. The base has to be anchored to the bottom with 24 pilings called pins. Each 450-ton pin is fabricated ashore, capped at either end and floated to the site. Again water is pumped to a predetermined level and the pin slowly assumes a vertical position. A slight negative buoyancy makes the pin reasonably "light" while it is fitted into a newly designed "elevator" attached to the derrick barge.

Once firmly clamped to the elevator, a television-camera-and-light unit is lowered through the pin's hollow center. An electronic receiver is also lowered.

Back in the computer room engineers again operate winches and listen and look as the computer flashes out facts and figures showing where the pin is in relation to base transponders located at several spots.

"The transponder lets us come within 10 feet of the base sleeve," says Pete Casbarian, project manager, "then the TV camera takes over. We know the pin is outside the base, so when we see the base sleeve's capture unit we start to line up the pin with this cowcatcher. When it's aligned, we literally slam the end of the pin into the catcher. When it has caught, we lower the 7-foot-diameter pin into the 8-foot-diameter sleeve."

The pin's own weight will rapidly drive it 150 feet into the mud and clay. But now comes the tricky part—driving the pin to its ultimate 450-foot depth. A specially designed hammer is lowered. It is the largest underwater hydraulic hammer in the United States. It develops 650,000 foot-pounds of energy and drives at a rate of 15 blows per foot.

Once the hammer is set up, it takes 1½ hours to drive the pile to the 450-foot level. Eventually, grout will be pumped into the sleeves to cement the pins to the base.

Diving breakthroughs

One of the other astonishing aspects of this operation involves the diving teams. When it's time to place the grout, divers using saturation breathing techniques supervise the underwater part of the job.

The divers, too, are extending their technology. Until Cognac, only

(Please turn to page 200)

The new Chrysler Chargers. Ferociously fast!

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(Continued from page 198)

two hours of work at depths requiring saturation techniques had been recorded in other parts of the world. As of September, 230-plus man-hours had been recorded for Cognac divers working at depths of 900 to 1000 feet of water. These men, who work for Taylor Diving, are also using other breakthrough devices. The divers work in an atmosphere that's composed largely of costly helium. Because of its high cost, they are using newly designed hel-

metts capable of "scrubbing" the helium, thus making it reusable.

The men also use a voice decoder, since the human voice becomes very squeaky after protracted breathing of helium. For those outside their world to understand them, the divers must speak through these electronic aids.

Decompression takes 9 days

The divers stay in a state of saturation for 39 days. It takes a day

and a half to get the body equalized to the proper pressure. The men are then available for work for 29 days, and it takes 9 days more just to decompress. All this time, the men are either in a small, pressurized tank aboard the derrick barge or they are working from a diving bell with their partners hundreds of feet below the surface where the water pressure on their bodies runs about 400 pounds per square inch. The water temperature is 50° F. and the fishing's fine. Surface crews monitor diver action through TV cameras mounted on the divers' helmets. Cognac is really stretching the state of many arts.

Before the first drop of oil surfaces at Cognac, \$700 million will have been spent by Shell, with lot leasing, planning, exploring, construction and drilling taking almost a decade. Part of that cost was to engineer and build the \$275 million platform that will live for 50 years and be able to withstand hurricane winds of 150 mph as well as 70-foot waves. The platform is designed to take the worst storm nature could throw at it in 100 years.

With the base down, the 315-foot midsection will come next, followed by the 530-foot top capped with the platform and two drilling towers. The first oil will be piped ashore some time in the 1980s.

This will probably be the last giant drill rig built in waters of this depth. New technology has pushed engineers on into submersible drilling. This technique will be used in future wells in water thousands of feet deep. **PM**

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APPLIANCE CLINIC

(Continued from page 78)

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Appliance Parts and Service Co., 400 Ninth Ave. North, Seattle 98109 (206/622-0152); West 917 Mallon, Spokane 99201 (509/328-7062).

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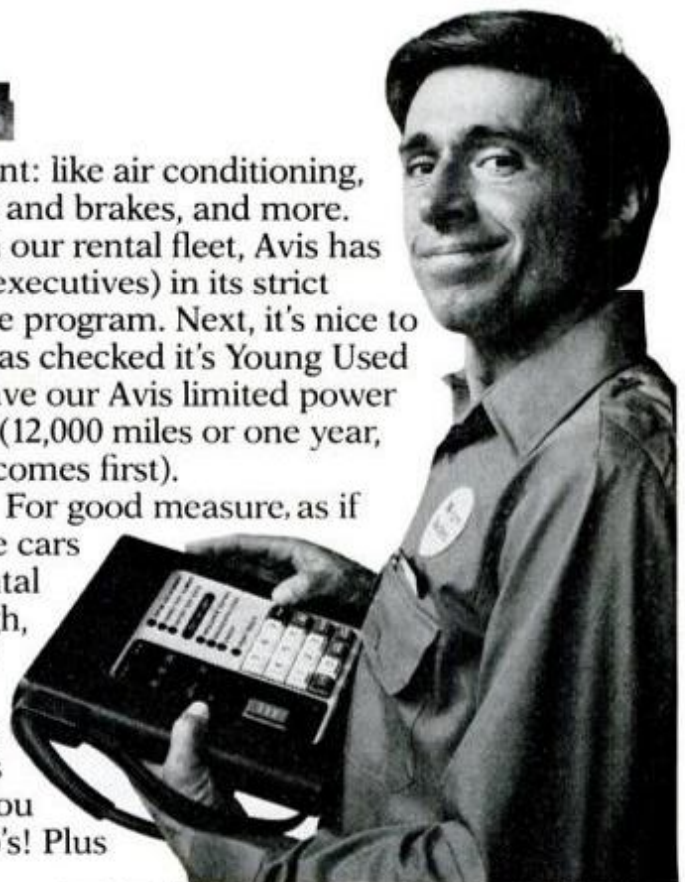
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in the marketplace for a longer period of time. Very few cars have survived longer than six years in the U.S. market without major changes. The Ford Model T and the Volkswagen Beetle are two rare exceptions. If we continued the cycle longer than six years, we'd be forced into a major facelift—where the basic body remains, but most exterior sheet metal panels are changed. Facelifting a car can be just as difficult as creating an all-new car.

PM: GM has always been a champion of the "styling sells" idea. Granted styling still sells some people, hasn't styling taken a back seat in recent years to functional and/or utilitarian considerations?

Rybicki: There's a misconception by some people that so-called "styling" is just adding a few frills to an existing product. Several years ago GM changed the name of the styling staff to design staff to better describe our actual function. We begin a design program with a definition that completely details the objectives. From this, the designers evaluate all functional and utilitarian considerations prior to beginning the actual design work. During all phases of our design work we evaluate the function and practicality of everything we do. You can't separate function and good design. A functional product works well and a well designed product is a functional product that is good looking. A good looking car doesn't cost any more to build than an ugly car.

PM: How soon will we see an "all Rybicki" car?

Rybicki: Never! I'm a firm advocate of the philosophy that it takes a team to design a successful car. Engineers, human-factor experts, aerodynamic specialists, research scientists, production experts, product planners and designers working together toward a common goal. I look at myself as the catalyst to stimulate the creative directions for our designers to investigate. I paint word pictures of the general direction I'd like our designers to pursue. Once the direction is established, it becomes a team effort. No one man can do it all.

If you're asking when cars will be introduced that were designed under my administration, then I'd say the final design decisions for the 1979 E bodies are "my" cars. The facelift of the 1980 full-size cars, the 1980 Seville and from 1981 on, all car designs will be under my administration.

PM: What's the most advanced model year you're working on now—1980-what?

Rybicki: In the production studios we're working on the 1982 cars. In

the advanced studios we're studying vehicle concepts for the years after 1982.

PM: The auto companies say the public dictates what it wants in cars—the "we give 'em what they want" line. If you're working five, six or seven years down the road, how can you know what the public will want that many years from now?

Rybicki: Our programs begin approximately four years prior to public introduction. But the design isn't finalized until about 18 months before production. We have compressed this time as much as possible so we can stay in tune with changing trends. Pre-production models are market tested as early as possible to eliminate any objectionable features or models. The ultimate success of any automobile is still measured by its acceptance in the marketplace. Like a fashion designer, the automobile designer bases his survival on his ability to predict and design products that will sell tomorrow. It's a tough job and the risks are high. But as designers, these are the risks we must take.

PM: GM used to be—maybe still is—the big gun in designing cars, al-

*'A good-looking car
doesn't cost any more
to build than an
ugly car.'*

though Ford might take issue with that opinion. With the government dictating more and more of the content, size, capabilities—do this, don't do that—of automobiles, there isn't much room left for innovation. So the question is, will cars of the future become more look-alike, more built-alike? Is there still room for individuality?

Rybicki: You're right, it's more difficult to make each model distinctively different in appearance. Especially when you try to package four people in a small vehicle—such as a Chevette—with adequate luggage capacity, meet all the safety mandates, emission control requirements, the fuel economy requirements and still maintain the comfort, convenience and performance demanded by the customer. You quickly discover that your solution is very close to your competitors'. In fact, small cars worldwide are all very similar in appearance. Japanese, German, French, Italian, English and American small cars are all beginning to look alike. We're aware of this at GM and are trying to correct the situation. We're working on small cars that will be fresh and distinctively different from the cars now on the road. Rest assured, as long as there's a GM de-

sign staff, we'll be working hard to create new and exciting products. Products that lead the way.

PM: Will there be more standardization, commonization of body panels on GM cars of the future? Can't avoid it, can you?

Rybicki: As tooling and production costs escalate, commonization is a must. Most of the additional commonization that I can foresee will be in the area of inner panels. But these are basically structural panels that will have little, if any, effect on appearance. We're also looking at new body configurations that can be adapted from common parts. This has the potential of increasing the models available to the public without increasing unit costs.

PM: Back in the anything-goes days in styling, engineers used to complain that the designers came up with the package and they—the engineers—had to fit the pieces in where they could, like it or lump it. Now it's the other way around. Safety, fuel economy, pollution control and other factors take priority over design. Does it bother you that you've become the No. 1 car designer in the United States at a time when design plays second to other considerations?

Rybicki: No, because design has never played second fiddle to anything else. It's important to understand how a car is really designed. Designing an automobile always has been and always will be a team effort, as I said before. Everyone works together toward a common goal established by corporation management. I've never seen a day when we haven't worked together as a group. There's a misconception by many people that the designer works alone. That has never happened, never will happen.

PM: We hear a lot about so-called "world cars"—a standard shape, size and mechanical package sold all over the world. Your department even has an international design studio within the design department. Even so, I don't see many American cars that are really world cars. Your thoughts on the world car?

Rybicki: It's true that in the past American tastes in automobiles were completely different from those of Europeans. But attitudes are changing all over the world. I see the automobile market rapidly becoming international. European and Japanese domestic cars are becoming larger and more sophisticated. At the same time, we are downsizing our cars. Within a few years we'll be producing cars in the same size and price range as they have. Add to this the necessity for commonization that I mentioned previously, and you can see the evolution

(Please turn to page 204)

Showing off your new diesel pickup.



Ol' Gib who runs the filling station doesn't impress easy. But the sight of your new GMC sure did bring him out of his chair. After all, it was his first chance to get a look at one of this country's first diesel-powered pickups—and a V-8 diesel at that.

Of course, you don't have to tell Gib a thing about diesels. He knows all about 'em from the 18-wheelers. Like how simple they are: no spark plugs, points, condenser, rotor, distributor, carburetor or catalytic converter to fuss with.

And talk about engine maintenance. Why, according to the owner's manual, all you have to do is change the oil and filter every 3,000 miles in normal operation, and give the crankcase ventilation a check every 6,000. Now that's easy to live with.

And the benefits don't stop there. EPA mileage estimates are impressive. 20 mpg city. 27 mpg highway. These ratings were achieved with the new 5.7 litre diesel engine and standard automatic transmission. Your mileage depends on how you drive, where you drive, your truck's condition, and its available equipment. Note: GMC pickups are equipped with GM-built engines produced by various divisions. See your dealer for details.

One more thing. As old Gib knows, diesel fuel traditionally costs less. In July, 1977, diesel fuel was 10¢ per gallon less than unleaded regular gasoline, according to the Office of Energy Information and Analysis Report dated 9/77.

So be one of the first. See your GMC dealer and ask him about the new GMC diesel pickup.



Nothin' goes truckin' like a GMC.

of a world car. The Chevette is a close example of what I mean.

PM: We also hear a lot about the European and Japanese influence on Americans cars in both design and mechanicals. Do you agree that the car builders in other countries have taken the ball away from American manufacturers?

Rybicki: I'm not an engineer, so I can't comment on mechanical comparisons between foreign and American cars. But I want to say this: American cars are very reliable. Very few foreign cars can be driven by American standards without mechanical failures.

Something else: Considering the problems we have to solve and the market we cater to, the American automobile industry has been the world leader in design. I'd be the first to admit Europeans have designed some beautiful sports cars that are trend setters. But when it comes to a family sedan or station wagon, foreign designs are very weak. Other than the Jaguar model, I don't think Europe or Japan has produced a successful four-door sedan. In this country, we design a greater variety of vehicles than all of Europe and Japan combined. You'll find they frequently copy our designs.

PM: Cars used to be built to accommodate six people. That was reduced to five people and now we are seeing more and more four-passenger designs. Is four the minimum, or will we eventually see two and three-passenger cars?

Rybicki: We will retain the full-size six-passenger sedan. But you'll begin to see an increase in four-passenger models in the very near future. As we approach the 1985 fuel economy requirement, we could very easily become interested in a two-passenger commuter, providing it is functionally sound and a very exciting form. This car could possibly be front-wheel drive.

PM: Assuming it was possible and practical to reposition the engine, would you like to see it mounted elsewhere than in the front? If so, where?

Rybicki: With smaller cars, the front-wheel drive configuration is the most practical. It eliminates the intrusion of a drive shaft and rear axle into the passenger compartment. From the standpoint of the designer, the front-wheel-drive arrangement offers many advantages. For a two-passenger sports type car, the mid-engine configuration appears interesting. From the designer's point of view, the mid-engine location allows for a lower hood and a more attractive package. The lower hood also reduces aerodynamic drag, which improves fuel economy. So you

could say that for different types of vehicles, variations in engine locations are definitely possible.

PM: The pickup has become a big number with people who used to reject trucks for status reasons. You've had experience designing trucks. Can we look for new types of pickups from GM?

Rybicki: Now that we're beginning to be affected by government fuel economy standards for trucks, you can expect smaller trucks in the very near future. Our downsized truck programs are already underway. We're encouraged by the acceptance in the market of the small pickups from Japan. We're going to meet that challenge and add a few wrinkles of our own. This doesn't mean we'll reduce the size of all trucks. Trucks for commercial use will continue to be somewhere near the size they are today.

PM: What can you tell us about the new van GM has coming in 1980 without getting yourself in trouble with the higher-ups?

Rybicki: We're looking very seriously at a new smaller van. But the plans aren't completely finalized. We're still considering all the options.

'Designing an automobile has always been and always will be a team effort.'

PM: I drive a lot of different cars as part of my job and the thing that bugs me from an aesthetic standpoint is the instrument panel. It's a mess of gewgaws, doo-dads, levers, push-pulls, knobs, gizmos and gauges. How about cleaning it up?

Rybicki: Several years ago we commoditized instrument panel locations for the various functions. These were studied and improved by our human factors experts. Concern for visibility, operation and reach affects the design of all controls. We're also concerned about the personal preferences of the customer. Someone who buys a Cadillac demands a more expensive-looking instrument panel than someone who buys a Chevette. That's why we offer a wide variety of instrument panels. But functionally they are all very similar. In the future we'll be moving toward digital instruments. With an on-board computer, there are many things we can do to simplify the instrument panel while offering more information to the driver. Touch controls can eliminate many of the knobs and switches in today's cars. These things will be available in the near future.

PM: You were around when Ray-

mond Loewy was designing cars, the post-World War II Studebaker in particular. Loewy used to say the two best designed containers were the egg, designed by nature, and the Coke bottle, designed by man. What's your idea of a perfectly designed product—other than an automobile?

Rybicki: What's perfection? At best it's only an illusion, a dream. The perfect design is approached but never achieved because trends and styles change constantly. What was right and beautiful yesterday is no longer accepted today. Taste and technology are very fluid and as changes occur, we must move with them. Take a look at the watch industry. Ten years ago a beautiful watch with elegant sweep hands and a precision movement might have been considered the ultimate in design, complete perfection. Today the hands are gone, so are the dials and self-winding movements. Instead we have a black face, semiconductors and digital read-outs.

I think everyone in the field of design is striving for perfection. But it hasn't been achieved. If you were to design the perfect automobile, you'd never have to change it. But what is perfect and who is to make that judgment? I know I can't. The consumer decides what's good, what's bad. He buys what he likes.

PM: Alice-in-Wonderland question: Suppose GM gave you the combination to the vault and told you to turn out a no-strings, no-restrictions car. "Go to it, Irv." What would it look like?

Rybicki: You're right. It is an Alice in Wonderland question. Let me answer it this way: To design a car, you must—emphasize *must*—have restrictions to guide you. The size, weight and performance requirements are a must. But too many restrictions can be as bad as none. I'm not trying to squeeze out of answering the question. That's just the way it is. A designer needs a starting point. He may not like the restrictions, but that makes him work twice as hard to show you the restrictions are bad or that he can do a good job under adverse conditions.

Another way of putting it: How do you know which direction to travel if you don't know where you are to begin with? The first thing you need to know before taking a trip is where you are. Then you should know how you're going to travel, what direction to take, how long it's going to take to get there and when you want to arrive. Most of all you have to know when you have reached your destination. In a sense, I've just described a design program. Without restrictions, you'd never know what direction to take, how to evaluate your progress or when you've arrived at a solution. So much for the Alice in Wonderland question. **PM**



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PM018

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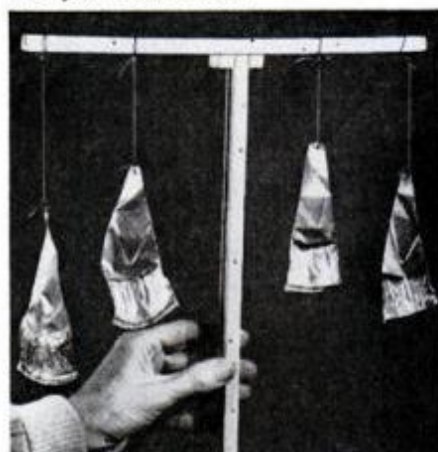
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HINTS FROM READERS

Pie-pan scarecrow



To keep birds from newly planted seeds, I cut triangular segments from an aluminum pie pan and suspended them over the seeds from a staked crossbar. The lightweight aluminum is in constant motion and contact.

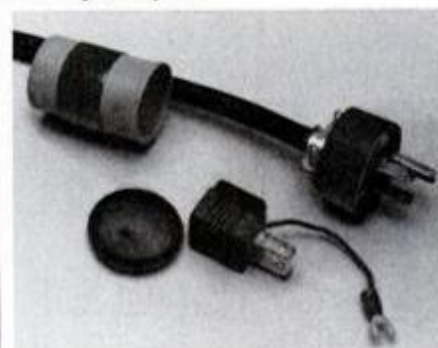
—Walter E. Burton

Iron is paint scraping aid

When its steam mechanism stopped functioning, I used my old electric iron to help scrape paint from my house. After adding an extension cord to the line cord so the iron would reach cracked exterior paint, I heated the iron and let it slide slowly over the old paint while I followed with a scraper. The results were amazing. Layers of old paint were far easier to remove than usual.

—Herbert Seligson

Handy adapter



A three-into-two-prong adapter fits nicely inside a 35-mm film can. Tape the can to a power cord near the plug and its handiness will encourage proper grounding of the three-wire cord. Be sure to connect the ground lug to the plate screw of the outlet box.

—Stephen Peterson

PLASTIC MODELS

(Continued from page 108)

reasonable facsimile—he wants total realism. The enthusiast magazines like *Military Modeler* and *Scale Modeler* review new kits on the basis of authenticity and accuracy to scale. Rigid sticklers for detail often visit museums and military bases to make their own measurements and photos. Sometimes they combine several kits from different manufacturers to make one accurate model. If that's not enough, they grind areas down or build them up as necessary (a universal complaint is that rivets are always too large). They use the word "accurize" a lot.

Despite the modifications a detail-fanatic will make, the general consensus is that the manufacturers are doing their homework well and provide excellent kits. Most customizing is now done to convert from one version to another. With a 98-cent conversion kit, a modeler can change his 1/72-scale Airfix Heinkel He-111H-20 into an He-111H-4 by modifying the dorsal canopy, ventral gondola and exhausts.

There are those who disdain kits completely. The scratch builders are the elite of plastic modelers. They pride themselves on doing their own research, scaling and construction. They carve beech-wood molds for the main structural parts of models and use these to vacuum-form styrene parts. They scavenge smaller components from kits. The whole process takes twice as long as building a kit, but the resulting level of detail can be much higher—and if you have to have a Piaggio P108B, scratch building is the only way to go.

Bufs add to or improve kits

Superdetailers add to or improve existing kits. A superdetailed kit model has been researched and accurized, and is an exact replica of the original, inside and out. Some modelers spend hundreds of hours refining the most minute details of \$3 kits. The work might be construction of an interior for a tank, complete with crew, or fabrication of a diorama showing it in action amid the ruins of Stalingrad.

The superdetailer puts his model into a time frame—it must look the way the real thing looked in use, so the final finish is of supreme importance. A German tank on the Russian front will show the ravages of battle. It will be covered with dirt and caked mud. Armor may show dents from small-arms fire. The crew's uniforms will be faded and rust will show around rivets. It will

carry tree branches for camouflage. (There is, however, some dispute between engineering realists and artistic realists as to how far one needs to go for authenticity.)

Military figures in plastic have captured the interest of many detail-oriented modelers. Less expensive than their lead-soldier equivalents, they offer the same challenge and, like the one on page 107 built by Jack Kennedy, can't be distinguished from metal when properly finished.

Most of us model strictly out of the box. We aren't usually too concerned if a kit is missing an obscure panel line or if the rivets are a little too big. What we want is a reasonable challenge, and a chance to produce a model we can proud of.

Nevertheless, taking a cue from the superdetailers, the manufacturers are offering larger, more complex kits designed for adult modelers. These kits offer complete interiors and engineering details like hinged canopies and working suspensions. They also cost a lot.

Revell recently introduced large-scale, highly detailed aircraft and sailing ships. Their 1/32-scale Phantom F4J is almost 2 ft. long and is a line-for-line copy of the original. It has moving parts, a reach-in cockpit with instrument panel, removable J-79 turbojet engine with afterburner, pilot and radar-intercept officer in flight gear and a full ordnance payload. (Even at \$8, it's a bargain compared to what the government has to pay for one.)

MRC/Tamiya sells a sizable assortment of large-scale aircraft, competition cars, bikes and armor at \$20 and up. A 1/16-scale Harley Davidson FLH 1200 Police Type is \$45. The exploded drawings of the \$22 1/12-scale Matra cover 16 pages and look more like a shop manual for the original than plans for a model. You'd probably be arrested for espionage if you were caught in the wrong place with the instruction book and specifications for Tamiya's \$35, 1/25-scale Centurion Tank in your possession.

Whatever vehicle you like, there's probably a plastic model kit of it, already available or in planning. Thousands of kits are produced at prices from \$1 to \$100.

You may be a member of the white-collar army during the day, but in the basement at night it's a different story. There's magic in even a \$2 kit, and the box art alone for a Revell Spitfire stirs the blood. You tear away the cellophane, pull out the two fuselage halves, stick them together and feel the surge of adrenalin. Once again, a little older, maybe, you're a Yank in the RAF. **FM**



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Build one of our exquisite grandfather clocks. Create a real conversation piece and family heirloom. Kits are Red-i-Kut, easy-to-build, semi-assembled of solid 3/4 in. kiln dried mahogany, cherry or walnut. Tubular bell or Westminster rod chimes. Spun brass Goddess Diana Lyre or Lady Florentine pendulums. Send \$2.50 for set of three plans, AMERICAN CLASSIC, SPIRIT OF MOUNT VERNON and SPIRIT OF THE CENTURY plus full color descriptive literature, and specifications on all kits and movements. Est. 1916 KUEPPEL CHIME CLOCK WORKS & STUDIO, 21195 Minnetonka Blvd., PM-84 Excelsior, MN 55331.

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(Continued from page 94)

trams are things to watch for. Balloons are a big thing this year, with meets in many states. (You can even get *glider* rides in some places for \$5 each.)

One pastime we found was watching dirty trucks roll into huge "Truckomats" and come out gleaming. At Meerdunk's monster truck-wash, in a truck stop at Jacksonville, Ark., we saw enormous super-brushes whirling grime away. For \$20 a vodka truck bound from Cincinnati to New Orleans got a bath. Then for another \$20 it got "acidized"—sprayed with a solution that made it shine like new.

Beware the repair shop ripoff

Most shops and garages are honest—but tourists are considered fair game by some unscrupulous repairmen. We've heard grim stories of overcharges and fake repairs. And a road-service expert gave us a warning that I pass along to you: "In a strange place, never let your car out of your sight. Things can happen to it. You go in with a minor job and they suddenly 'find' a big one." Best bets are reputable shops which will

accept your credit card for payment. Another safeguard is auto club certification of repair shops.

Begun in Minnesota, Florida, California and the Washington, D.C., area, the idea seems sure to sweep the country. Shops are investigated and given "AAA approved" signs. They must give AAA members estimates, good work, fair prices.

Start looking for the signs. Even if you're not an AAA'er they'll help you identify a responsible shop!

Other tips:

- If you like to read in bed, better carry along your own 100-watt bulb. Most motel bedside lamps now use bulbs of 60 watts or less.
- Never leave cameras or cash in your motel room—even during dinner. Lots of people have room keys today!
- Some motel rates are now quite low. In Deming, Tex., where we had a \$22 room we saw a Motel 6 being built across the street, and already advertising: "Single, \$8.95."
- Best food is often in small towns off the Interstates. Find the "family places" where local people eat. That's

where you'll get good meals and desserts, usually cheap. Don't be fooled by the popular notion that the best food is where you see the most trucks. It isn't! "Only reason we come here," truckers told us at one stop, "is there's a good place to park." (Trucks smash blacktop, so some restaurants actually bar them from parking lots.)

Nothing spoils a trip more than a sleepless night. So we learned to avoid: (1) busy convention motels, (2) rooms near music, ice machines, soft drink dispensers, or rumbling airconditioner compressors. And near highways where traffic roars uphill, ask for a quiet room *away* from the road.

We were warned by Michigan's motor club that we'd find reservations more necessary than ever this year. We did. But some motels now have their own CB base, so you can make your reservation by radio—a CB can be nice to have along. Best idea if you lack CB: Make tomorrow night's reservation as soon as you check in tonight. Use the free reservation phone or computer service.

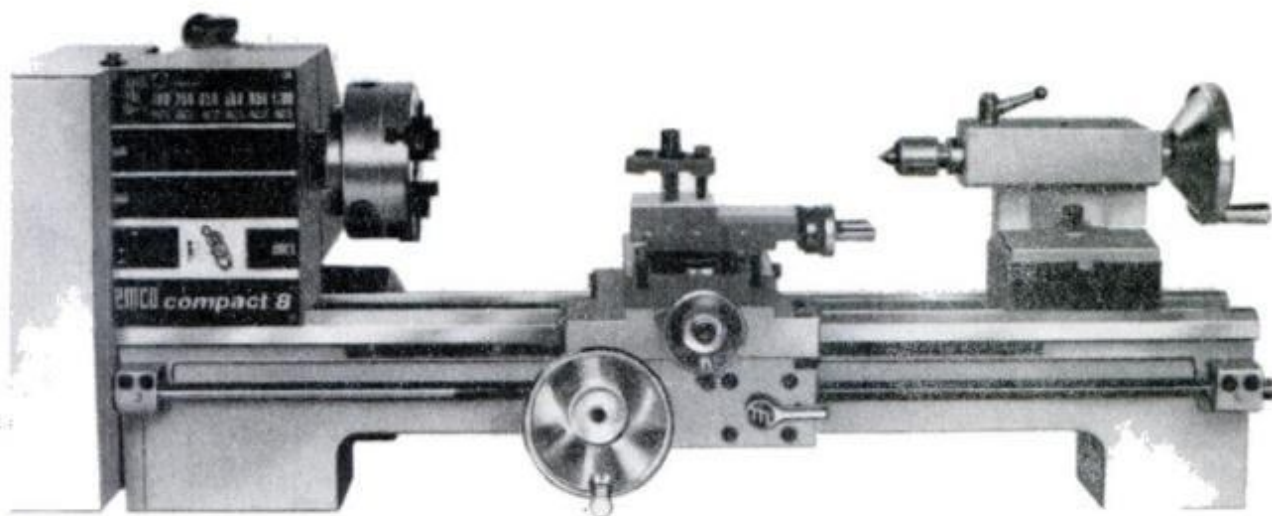
And . . . have a safe trip! **FM**

1978 FORD

FORD LTD II
FORD DIVISION

Ford
75 ANNIVERSARY

Four new tools that make the job easier



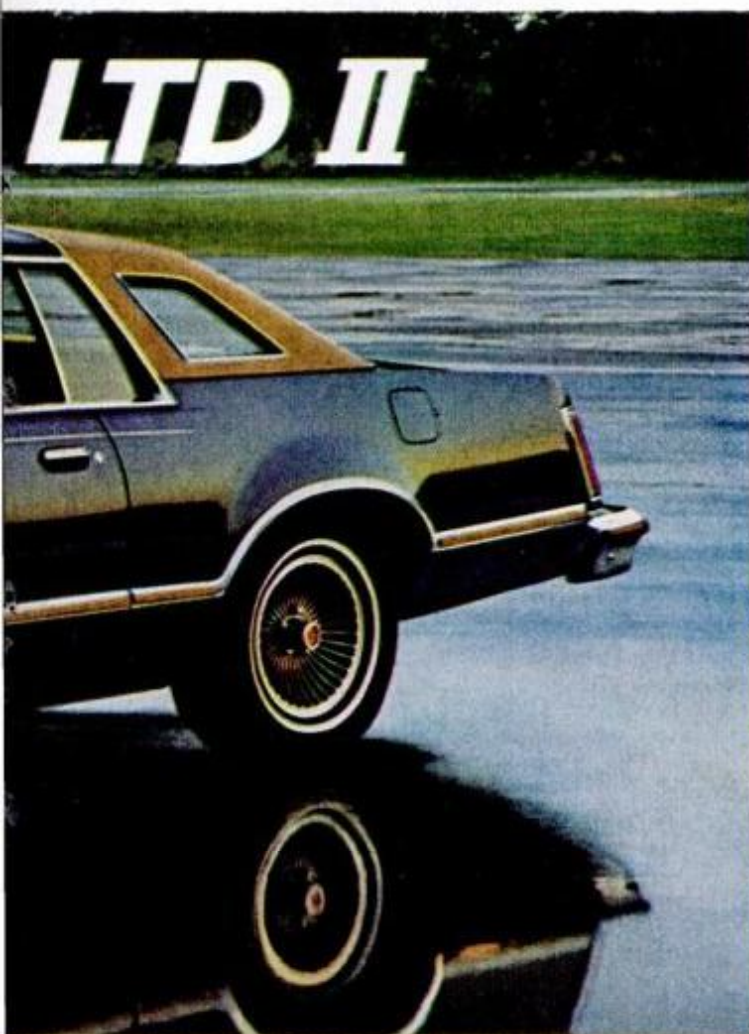
This compact center lathe is a helpmate for precision mechanics, modelmakers, automotive repairmen, scientific technicians and educators. It performs the standard operations, including the more important ones of longitudinal turning and facing, external and internal taper turning and thread cutting. The Emco Compact 8 is designed with a strong main spindle, an

adjustable taper roller bearing and a toothed belt.

The lathe has 1/2-hp motor and a spindle speed that ranges from 100 to 1700 rpm. It weighs 128 lbs.; the distance between centers is 17.7 in. The Emco Compact 8 is priced at \$1195 by the manufacturer, Emco-Lux, 2050 Fairwood Ave., Columbus, Ohio 43207.

Designed for hard-to-reach places and to cut unusual shapes, this new hacksaw handle is manufactured by Century Drill and Tool Co., 5600 West Roosevelt Rd., Chicago 60650. It will saw sheet metal, plastic, wood and other materials. Handle and blade are \$2.50.

[\(Please turn to page 213\)](#)



The trimmer, sportier, mid-size LTD at a trimmer price.

The quality and luxury LTD is famous for is the whole idea behind LTD II. You get room for six, and a long list of standard features not found in most mid-size cars. Automatic transmission, power steering, power front disc brakes, V-8 engine, steel-belted radials.

Test drive LTD II at your local Ford Dealer. It's the LTD of mid-size cars.



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Ford puts it on wheels.



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The bucket seats are more comfortable, more colorful. And now you can order them in fun-to-touch fabrics. Mounted on curved tracks, the new seats allow a higher position for the shorter driver and more headroom for the taller driver. And you can order bench seating for up to 15 people.

2. MORE ROOM, MORE QUIET.

We've made the engine cover smaller to make the people compartment bigger and increase the footroom. And on Custom and Royal models we've put in more sound insulation and made suspension improvements to make the ride quieter.



3. EXCLUSIVE TRAVEL SEATING PACKAGE. This new factory-installed option on B200 and B300 Royal Sportsman lets you easily convert from two three-passenger bench seats to a dinette set to a double bed. The wood-grained-finish tabletop stows out of the way when not in use. The package makes your Sportsman into a home away from home.

4. 23MPG HWY / 17MPG CITY.

EPA estimates for Dodge Sportsman B100 wagon, with standard 225-cubic-inch six-cylinder engine and manual transmission. Pretty good for a wagon that does this much work. Your mileage may vary according to vehicle condition, equipment, and how it is driven. California mileage is lower.

Room for more cargo and more fun. And its rear quarter windows wrap right around the corners to make backing up a snap.



5. NEW OPTIONS.

Sky Lite sun roofs, air conditioning, and more. Trailer-towing packages for up to 7000 pounds gross trailer weight. Six different kinds of radios including units with 40-channel CB.

Put our new features together with Dodge dependability and value, and you'll see why we keep on selling more wagons than anyone. Buy or lease one or a fleet . . . at your Dodge Dealer's.

6. MORE ROOMINESS.

Maxiwagon has eight inches more loadspace length this year.



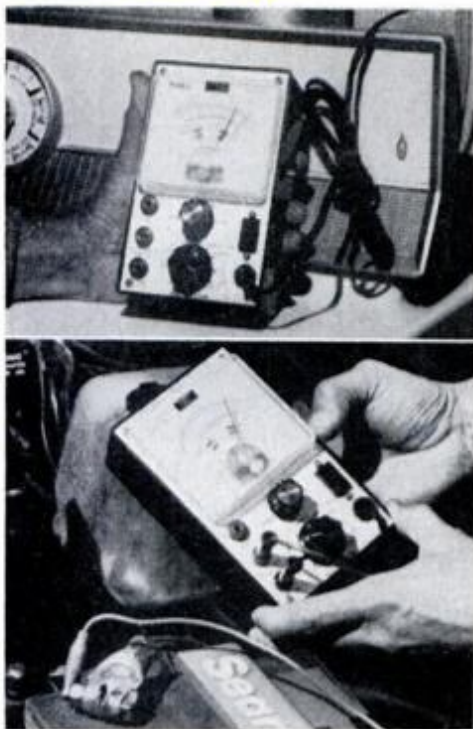
NO.1 IN VANS AND WAGONS.*

* Passenger van-type vehicles known in the industry as wagons.

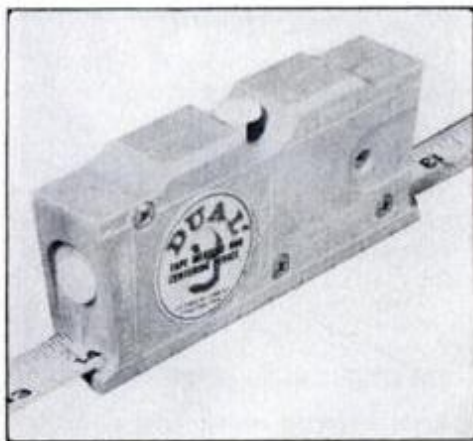


FOUR NEW TOOLS

(Continued from page 209)



Locate problems in both electrical appliances and automotive electrical systems with the Eico model 540 appliance/auto multimeter. Just plug the tester into a wall outlet for a quick check of the line voltage. Measure your car battery's voltage as well. To see how much current a home appliance draws, plug it into the multimeter and read the dial. The tester has two scales that check for wiring breaks in any appliance and make sure its power cords and extensions aren't defective. It comes in kit form or factory-wired for \$22 and \$30, respectively. Eico, 108 New South Rd., Hicksville, N.Y. 11801.



The Dual-2 Tape Measure and Centering Device lets you measure in two directions from a central point. You can easily locate the centers of floors, walls, entranceways and many other objects. The Dual-2 comes in handy when you're laying floor tile or measuring for replacement windows. A centering scribe located at the center of the steel case lets you mark for lumber cuts and score plasterboard. It can measure arcs and circles conveniently. You can change measuring blades easily when one wears out. Cost is \$21.45 postpaid from Dual-2 Tape Measure Co., Box 16296, San Francisco, Calif. 94116. **PM**

Richard Petty says, "If you really want to learn how to repair cars, check out NRI home training."

**They give you all the training
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My Dad made auto mechanics out of us long before he'd let us enter a race... so I learned the importance of a good mechanic early... and the opportunities that are out there for well-trained men. That's why I'm sure glad to see training like the two NRI courses come along. With NRI, you learn at home in your spare time, at your own pace. And get solid, hands-on training for practical experience. It's a lot of training for the money.



Richard Petty, NRI Automotive Consultant and America's Winningest Stock Car Driver

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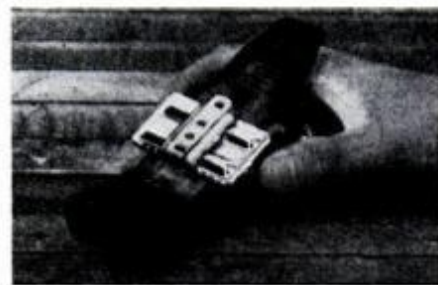
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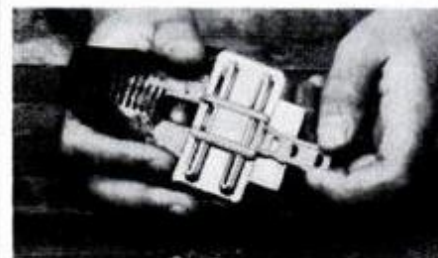
PM LOOKS AT STANLEY'S HONING GUIDE



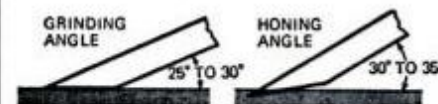
Teaching a woodworking course to adults has shown me just which workshop techniques do and don't frustrate amateur craftspeople. One that does is honing a plane iron or chisel with the blade held at the correct bevel angle. For many, this seems to be impossible, with the result that cutting edges



After inserting the blade bevel side down, tighten thumbscrews lightly.



Setting gauge is flipped down to align blade. Tighten thumbscrews fully.



Grind bevel to match original angle. Hone with back edge slightly raised.

are often honed with a rounded-over (thus dull) configuration. Stanley's honing guide makes this impossible because once the blade is locked in position, it doesn't move as it is stroked on the whetstone. This tool does not eliminate grinding, but it can make it easy to hone a perfect bevel. It's \$9.10 from Stanley Tools, Dept. PID, Box 1800, New Britain, Conn. 06050.—H.W.

Enjoy a roaring fire...

the easy way, with PM's Log Splitter!

What could be more pleasant on a cold, cold day than the warmth of a roaring fire. And, you can have all the firewood you need and save time and money by splitting that firewood yourself. POPULAR MECHANICS LOG SPLITTER exerts some 10,000 lbs. of pressure and will easily split 2 ft. lengths of maple and ash logs 12 to 14 inches in diameter. With an I-beam backbone, double-acting hydraulic cylinder, control valve oil filter, 3-hp. gasoline engine and other features, you'll find this log splitter

easy to build and a fun thing to use. And, you'll save your back from aching as you split logs the easy way. Have more time to enjoy the crackling fire in your fireplace. Use it through this year, or start getting ready for next winter. Either way, it's a very sound investment. Send for complete plans and step by step instructions for just \$8.95. Send a check or money order to PM Plans Library-Log Splitter, Box 1014 Radio City Station, N.Y. N.Y. 10019

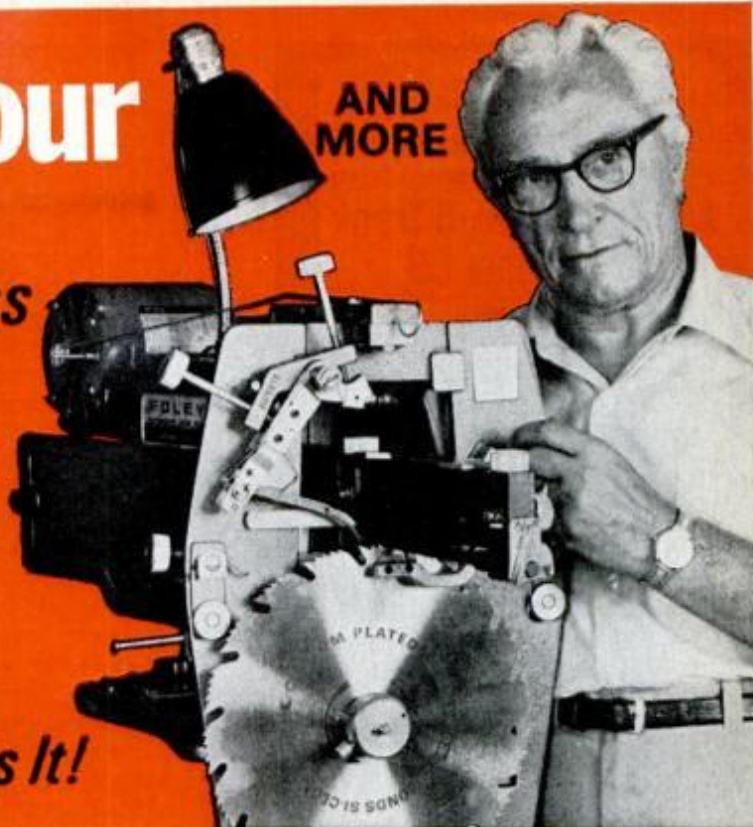
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ELECTRONIC IGNITION SYSTEM

(Continued from page 123)

This tests the electronic control unit ground circuit.

The ohmmeter should show continuity. If not, tighten the bolts that hold the electronic control unit to the firewall. Recheck continuity. If continuity still doesn't exist, replace the electronic control unit.

7. Remove meters and reconnect the wiring harness.

8. Check the air gap between a tooth of the reluctor and the pickup coil pole by aligning the two. Loosen pickup coil hold-down screw and insert a .008 nonmagnetic plastic feeler gauge between the two.

Align the air gap so contact is made between the reluctor tooth and the feeler gauge, and the pickup coil pole and the feeler gauge. Tighten the hold-down screw. You should be able to remove the feeler gauge without using force.

Double check the air gap by trying to insert a 0.010 feeler gauge between the two without using force. It should not fit.

9. Remove the vacuum advance hose from the source of vacuum. Put the end of the tube in your mouth and draw in, creating vacuum, and rotate the plate assembly.

If the pickup coil pole hits a reluctor tooth, the air gap is not adjusted properly.

If the pole hits the reluctor on the side, the distributor shaft is bent. Replace the distributor.

10. Remove the high-tension voltage cable from the center tower of the distributor. Hold it about 3/16 in. from ground with insulated pliers. Crank the engine. If the spark does not arc, you should replace the electronic control unit. Test again.

If spark still doesn't arc, put back the old electronic control unit and return the new one. Buy a new ignition coil instead.

Chrysler: Replacing pickup coil

1. Remove the distributor cap and rotor.

2. Remove the screws and lockwashers that attach the vacuum control unit to the distributor housing. Disconnect the vacuum control arm from the plate. Remove the vacuum control.

3. Using two screwdrivers, pry up from the bottom of the reluctor. Be careful not to distort or damage the teeth.

4. Remove the screws and lockwashers holding the lower plate to the distributor housing. Lift off the lower plate, upper plate and pickup coil.

5. Reverse the procedure to reassemble the unit, making note of these points:

□ To replace the reluctor, position the reluctor keeper pin in place on the reluctor sleeve, slide the reluctor sleeve and press the reluctor firmly in place.

□ Lubricate the felt pad on top of the reluctor sleeve with a single drop of light engine oil.

□ Set the air gap between the pickup coil and reluctor.

AMC's BID: How it works

This system consists of a solid-state electronic control unit, distributor and ignition coil. Their job is to produce and distribute a high-voltage spark at the precise time to fire each sparkplug.

Turning the ignition key to ON or START activates the electronic control unit, which is a moisture-resistant module. An oscillator in the electronic control unit excites a sensor in the distributor when the ignition switch is turned.

The sensor and a trigger wheel are the only parts of the BID distributor which differ from a conventional breaker point distributor. The sensor and trigger wheel replace the contact points, condenser and distributor cam.

The sensor is a small coil of fine wire. When it is excited, it develops an electromagnetic field. As the leading edge of a metal tooth on the trigger wheel enters the electromagnetic field, the metal tooth reduces the strength of the oscillation in the sensor.

This reduction acts as a signal to a demodulator in the ignition control unit, which controls a power switch transistor that is in series with the ignition coil primary circuit.

The ignition coil is an oil-filled, hermetically-sealed component that is the same as any ignition coil. It has two windings on a soft iron core. The primary winding consists of a comparatively few turns of heavy wire. The secondary winding consists of many turns of very fine wire.

BID: Finding the trouble

As in a conventional ignition systems, the job of the ignition coil is to transform relatively low voltage in the primary to the high voltage needed by the sparkplugs. In the BID system, this happens when the demodulator "orders" the power-switch transistors to switch off the coil primary circuit. A high voltage is induced in the ignition coil's secondary winding, which is distributed to the sparkplugs through the dis-

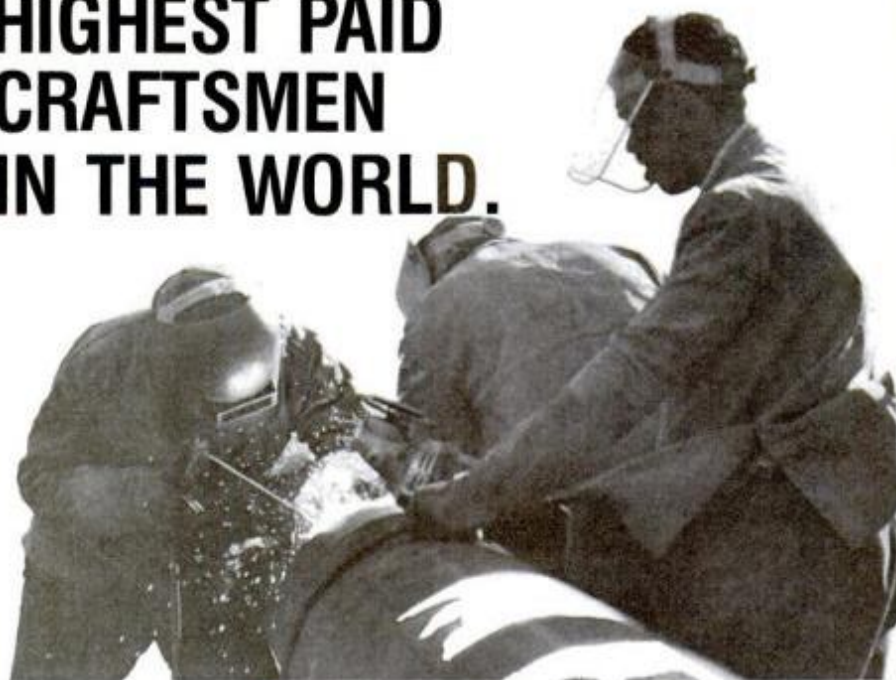
(Please turn to page 218)

Nancy and Dennis Stant
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APRIL 1978 217

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ELECTRONIC IGNITION SYSTEM

(continued from page 216)

tributor cap, rotor and high tension ignition wires.

One thing *won't* happen when components of AMC's BID system go on the blink: no spark will be present at the sparkplugs, and the engine won't start. By components I refer to the electronic control unit, ignition coil and distributor parts.

To check the system when it fails, you could purchase the BID Electronic Ignition Pulse Simulator. The tester is available from Kent-Moore, 28635 Mound Rd., Warren, Mich. 48092, under part No. J-25331-01, for around \$25.

However, the BID system can also be tested simply and quickly by using a No. 57 light bulb, a jumper lead and a pair of keen eyes. Cost: about 50 cents. Let's discuss the cheapie method here.

Find out if starting trouble is ignition-induced by disconnecting a high tension cable from a sparkplug. Using insulated pliers, hold the cable $\frac{1}{2}$ to $\frac{3}{4}$ in. from a clean spot on the engine. Crank the engine. If there's no spark, start probing the ignition.

1. If backfiring takes place when the engine is cranked, maybe the distributor cap is wet, cracked or dirty, or its terminals are loose. Replace a damaged cap.

If backfiring accompanies cranking, it's also possible for ignition timing to be out of adjustment or for ignition wires to be incorrectly connected.

2. Inspect the distributor rotor for damage. Replace if necessary.

3. A defective distributor-to-coil secondary cable will prevent starting, and frequently goes unnoticed by a troubleshooting mechanic. Disconnect and check it with an ohmmeter. Allowable resistance is 5000 to 10,000 ohms.

4. Disconnect the distributor primary wires, which are black and dark green, from the control unit connector, which is blue and white. Spread male connector with a punch or awl, and crimp female connector slightly to insure a tight fit.

5. If spark is still not present as you try to start the engine, hook up your No. 57 bulb. Call this test 1. Connect one jumper to the coil positive and the other to ground. Turn the ignition switch to ON and then to START. If the bulb does not light with the switch in one or both positions, a problem exists between the battery and coil. Specifically, look to a defective ignition switch or wiring.

6. If the bulb lights with the switch in both positions, connect the

bulb across the coil terminals. Unplug the distributor lead connector. With the ignition switch ON, the bulb should light. If it doesn't, replace the electronic control unit. Call this Test 2.

7. If the bulb does light, use a jumper lead to short across the electronic unit lead terminals. If the bulb stays on, replace the electronic control unit. This is Test 3.

8. If the bulb switches off, unhook the bulb from the ignition coil for Test 4. Disconnect one end of the jumper wire from across the electronic control unit lead terminals. Remove the coil-to-distributor secondary cable at the distributor, and hold its end 1/2 in. from ground. Be sure to use insulated pliers. Crank the engine and short out the electronic control unit lead terminals with the jumper.

If spark jumps the gap between the end of the cable and ground, the sensor in the distributor is causing the problem. Replace it.

If there is no spark, replace the coil.

BID: Replacing the sensor

1. Remove the distributor cap, rotor and dustshield.
2. Remove the trigger wheel. A

small gear puller is needed. Use a thick flat washer or nut as a spacer between the turn-down of the gear puller and the distributor's center shaft. Don't press directly on the shaft. Be sure the jaws of the puller grip the inner shoulder of the trigger.

3. Loosen the sensor locking screw about three turns. This screw has a tamperproof head design. Use a standard needle-nose pliers to remove the screw. Replacement sensors use standard slotted screws.

4. Lift the sensor lead grommet out of the distributor. Pull the sensor leads out of the slot around the sensor spring pivot pin. Lift and release the sensor spring. Slide the sensor off the vacuum chamber bracket.

5. To install a new sensor, place the sensor on the vacuum chamber bracket. Make sure the tip of the sensor fits in the summing bar. Place the sensor spring in position on the sensor, and route the sensor leads around the spring pivot pin. Install the sensor lead grommet in the distributor, and position the leads so they can't be caught by the trigger wheel.

6. You now need a sensor positioning gauge. It should have come with

the new part. Place the sensor against the flat of the center shaft yoke, moving the sensor sideways until the gauge can be seated. Tighten the sensor retaining screw snugly.

7. Check the sensor's position by removing and installing the gauge. If the sensor is properly positioned, you will be able to remove and replace the gauge without the gauge demonstrating side movement. Tighten the sensor retaining screw and remove the gauge.

8. Set the trigger wheel in place on the shaft yoke. See that the sensor core is positioned about in the center of the trigger wheel legs. The legs should not be touching the sensor core.

9. Put trigger wheel on the yoke.

10. Bend a 0.050 wire gauge to the configuration shown in Fig. 11 and place it on the sensor. Press the trigger wheel in place until it just touches the gauge. Remove the gauge.

11. Apply three or four drops of SAE 30 oil to the felt wick on top of the yoke. Button up the distributor and time the ignition to specification.

Note: There is no dwell adjustment to make. **PM**

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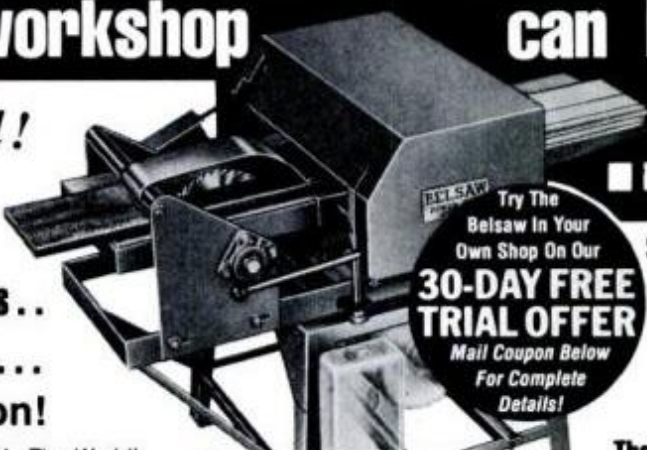
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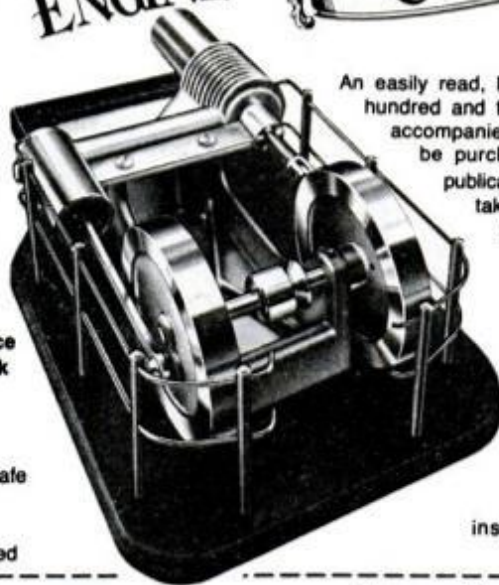
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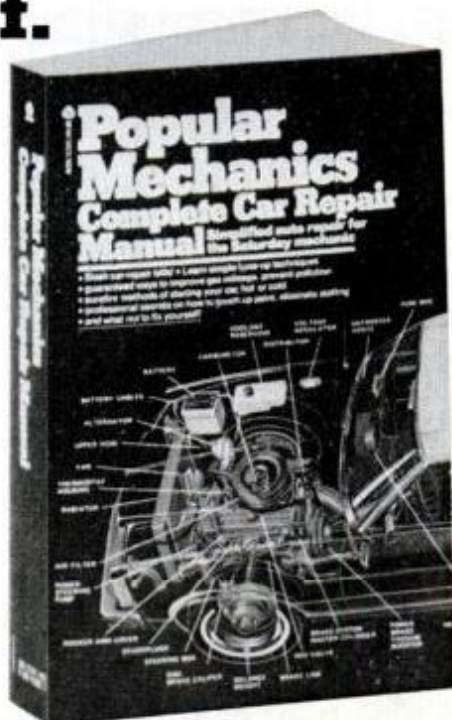
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TERMITES IN YOUR HOME?

(Continued from page 129)

take—often after taking other precautions against termites—is to build a wood trellis that provides a direct link from soil to house.

The best time to think about termites, of course, is *before* your house or addition is built. It's easy—just make certain that your builder's contract calls for soil pretreatment with a termite insecticide.

Soil pretreatment includes spraying of all the soil that will be underneath or around the outside edge of the house with a chemical. It's done after the foundation footing trenches, plumbing and electrical conduits are in place—just before laying the vapor barrier and pouring the slab.



Rail-support posts in contact with soil provide another opportunity for termites.

Extra chemicals should be poured in those areas adjacent to foundation walls and interior walls, and around sewer and utility openings.

When buying a termite-control job for an existing house, be sure to check the operator's references, and watch out for outfits that: Quote a price based on gallons of material, claim to have a secret formula or ingredient, have no listed telephone number, appear uninvited or want to include tree trimming and general repairs in the contract.

More information on protection against termites is in Dr. Haverty's booklet, available for 60 cents from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20403. (Stock No. 001-001-00420-1.)

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*Yeah—
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30-MILE 'DONUT'

(Continued from page 98)

inside it, you need "bullets" that are even smaller than the target; thus the use of protons—the "shotgun pellets" of the nuclear hunter. The problem is that an atomic nucleus repels these positively charged invaders with its own positive charge. To rip through this tough, invisible electrostatic barrier you need the vast amounts of energy that only giant accelerators can supply.

Entry ramp to a superhighway

After the proton generator, the next stage in the AGS is what's called a linear accelerator—a straight section the size of a main-street sewer and a quarter-mile long. This functions as a kind of entry ramp to a proton superhighway. In it, protons are given a starting push to get them up to accelerator speed. Every few inches, they are jolted along by bursts of 200-megahertz microwaves acting like giant paddles on a stream of water. The total force of this electronic push is 40 million watts, roughly equivalent to the output of 800 powerful radio transmitters.

By the time the protons leave the linear accelerator, they are traveling at nearly half the speed of light and have enough momentum to enter the high-speed lanes in the main, circular accelerator tube. Here, in this vast subterranean merry-go-round, the protons are whipped along faster and faster by additional jolts of 150,000 volts during each revolution around the giant ring.

Straddling the stainless-steel tube that contains the proton beam are 240 huge water-cooled magnets, weighing a total of 4400 tons. Clamping the tube like giant C-clamps, these magnets bend the beam into its circular path and keep stray particles from touching the walls. Any surface touched by wandering particles would instantly become radioactive. That's why elaborate safeguards constantly monitor the radiation level and automatically shut off the beam if it gets unruly and those high-powered protons break loose from their magnetic leash.

With a personal radiation counter pinned to my coat, I walked into the long tunnel containing the accelerator ring, accompanied by Dr. Mark Barton, chairman of Brookhaven's Accelerator Dept. The steel proton-beam tube glistened eerily, surrounded by a maze of cables—fat as a wrestler's biceps—used to feed tens of thousands of kilowatts of power to the massive magnets.

So precisely engineered is the AGS

that every part of the accelerator tube and its magnets had to be positioned within a few thousandths of an inch to make a perfect circle for the proton-beam track. Since even the slightest ground shift can be critical, the synchrotron rests on pilings 50 feet deep.

Works like a giant slingshot

At one point in the circle, a straight tube branched off on a tangent. "That's where we pull out the beam with a big deflecting magnet and shoot it off into the target area," explained Dr. Barton. Spinning the protons around the long circular tube is like whirling a stone in a sling before letting it fly off—with each whirl it accumulates more energy. As the protons leave the circle, their speeds of millions of miles per hour defy the imagination.

A proton with an energy of 1 eV (electron-volt) moves at 30,000 mph. At energy levels of 500 billion electron-volts, such as those achieved by the Fermilab accelerator, the protons are sailing along at a fantastic 99.99982 percent of the speed of light—nearly 663.6 million miles per hour!

For future accelerators, Dr. Barton pointed out, superconductive magnets cooled by helium to almost absolute zero temperature, minus 459.52°F., will be used in place of water-cooled magnets. These will multiply magnetic energy tremendously, increasing output to even greater levels while saving huge amounts of electric power.

Problem: Hitting the target

What happens when a proton beam slams into a target? That's exactly what scientists are trying to figure out. The kind of target used depends on the particular result being sought. Frequently, it's a thin metal plate. Most protons—millions of them—will pass right through such a plate without ever touching an atomic nucleus. They fly through the open spaces around a nucleus as if they were holes in a tennis racket.

What intrigues researchers is the rare, random hit that's scored when a proton just happens—by chance—to strike the very center of a nucleus. When this occurs, the resulting "explosion" shatters the nucleus into a whole new flock of subnuclear particles barely classifiable, still mysterious and utterly perplexing.

There is no way to see such particles directly since they are much smaller than the shortest wavelength of light. Yet scientists have devised clever ways of observing them indirectly. One is the use of the so-called "bubble chamber." Inside such a chamber, subatomic particles emerg-

ing from a shattered nucleus leave visible tracks of bubbles by causing a liquid to boil along their paths as they pass through. These tracks can be photographed and analyzed. From their angles and velocities, useful clues can be obtained revealing the character and behavior of the particles that produced them.

But bubble chambers are cumbersome and tricky, requiring elaborate controls. One in use at Brookhaven consists of a tank nearly four stories high in which liquid hydrogen is kept at temperatures near absolute zero by immense refrigerators. This liquid hydrogen must be decompressed at the precise fraction of a second that particles come whizzing through to permit it to "boil," producing the telltale bubble tracks.

The ultimate quest: 'quarks'

Today, newer and more sophisticated particle detectors are being developed using computers that instantly plot and analyze particle paths instead of having to wait for thousands of bubble photographs to be taken, sorted, studied and interpreted. The computers are programmed to recognize significant particle paths, separating them from those less useful or already known—an enormous time-saver.

What will come out of all this intense research? No one can say yet for certain, but the handwriting—or particle-writing—is on the wall. Not too long ago, physicists assumed the atom consisted of only two basic kinds of particles: protons and electrons. Now, thanks to computers and ever more powerful accelerators, more and more kinds of elementary atomic particles are tumbling out in what one Brookhaven physicist calls "a glorious and bewildering display of wonders."

Many physicists are now convinced that these apparently "bewildering wonders" are simply different forms of the same things—those elusive, still unidentifiable *quarks* believed to be the basic building blocks of the universe. One theory is that quarks were created in the "big bang" that presumably was the origin of the universe and that they have remained unchanged.

The VBA's gigantic jolts of energy could conceivably approximate the conditions of the original big bang closely enough to expose the real nature of these obstinate quarks. If so, we may be closer to unraveling the mysteries of the universe than anyone ever thought possible. But whatever we find out, the curious paradox is that it may take the world's largest machines to explore the world's smallest objects. **PM**

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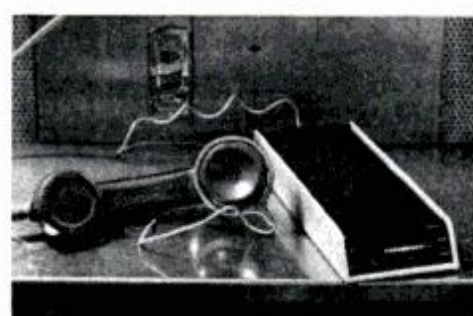
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SUPERPHONE
(Continued from page 117)



Hagoth, small box at right, registers a voice stress that may mean deception.

alert's Eavesdropper Stopper is \$40 from Phone City.

Automatic dialing is a feature you can get several ways. What it means is that a full number is dialed when you push a single button, or, sometimes, a two-digit code. The Bell companies offer two such devices. With them, you write the party's name on a list and input the phone number; from then on, turning the list to that point and pressing the "go" button dials the number. The "last number dialed" feature you'll see mentioned below means that the machine holds the number you dial, and if you hit a busy signal, pushing a single button will re-dial it.

One device that definitely exists, but doesn't seem to be available to the public yet, is a calling-number display. Hooked up to your line, it will read out the number of whatever phone is calling yours. At this writing, only law-enforcement agencies can get this gadget. But it seems reasonable that they could be made available to people who repeatedly get threatening or obscene calls.

A number of telephone recorders have recently reached the market, including several from answering machine makers. These record everything said on the line, with no tell-tale beeps. There's also an interface, from Phone City, that lets you hook up your own recorder to do this, and ITT is now selling a telephone with the recorder built in.

For what does Bell toll thee?

If it's the cost of phone service that's bothering you, there's help for that, too. There are a couple of call timers, the Time-Minder from Phone City and Eico's Time Limiter, that sound a beep on the line when a pre-set interval has elapsed. They're about \$30 each.

At \$16.95, Liberty Light performs the timing function with a flair. A miniature traffic light that sits beside the phone, it shines its green light when you pick up the handset,

(Please turn to page 226)

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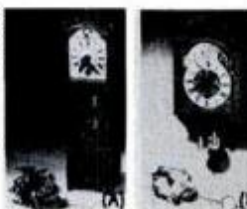
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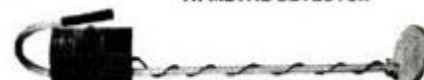
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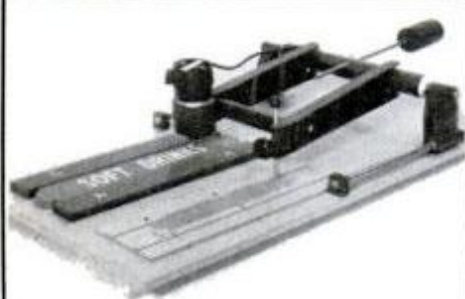
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SUPERPHONE

(Continued from page 224)

switches to yellow as you near the end of your preset time limit, then flashes red (with a dollar-sign) when you're into overtime. It doesn't signal on the line, but it's hard to ignore.

If tracking your phone costs is important, products from Utility Verification Corp. can help you. Their \$100 Tele Coster I is a special-purpose calculator with timer that comes with a directory of time and cost factors from your phone to any exchange in the country. Punch in the factors, make the call, and the Tele Coster will keep a running tally of time and charges, warning you of each new cost period 15 seconds in advance. For \$400, UVC's Computer Phone 370 does it all automatically, and redials busy numbers besides.

Hello, I'm freezing

The Telefreeze has been around for several years. It monitors the temperature of a building and alters the sound of a telephone's return ring if the temperature goes below a preset level. In other words, if you've heard of cold weather upcountry, you dial your vacation home. If you get the altered ring, you can get the local heating contractor on the scene before pipes burst. In some areas, heating companies sell the device as part of a service package, checking customers' systems from the office and making visits where needed. There's a jack-in unit with its own preset sensor for \$27, a standard unit that connects to the thermostat for \$38, and, where necessary, a party-line adapter.

Many of the devices I've discussed are given as projects in a little book, *Telephone Accessories You Can Build*, by Jules H. Gilder. Schematics and parts lists are provided, along with descriptions of the circuits' uses. I built one of the simplest, a "hold" button that keeps a call on the line while you go to another extension, then hangs up the first phone when you pick up the second. These projects aren't for the absolute novice, since you have to be able to translate a schematic into hardware. But they're not very complicated, the parts are readily available, and the savings over ready-made devices are considerable. The book is \$3.95 from Hayden Book Co., Inc. 50 Essex St., Rochelle Park, N.J. 07662.

The ultimate—truth

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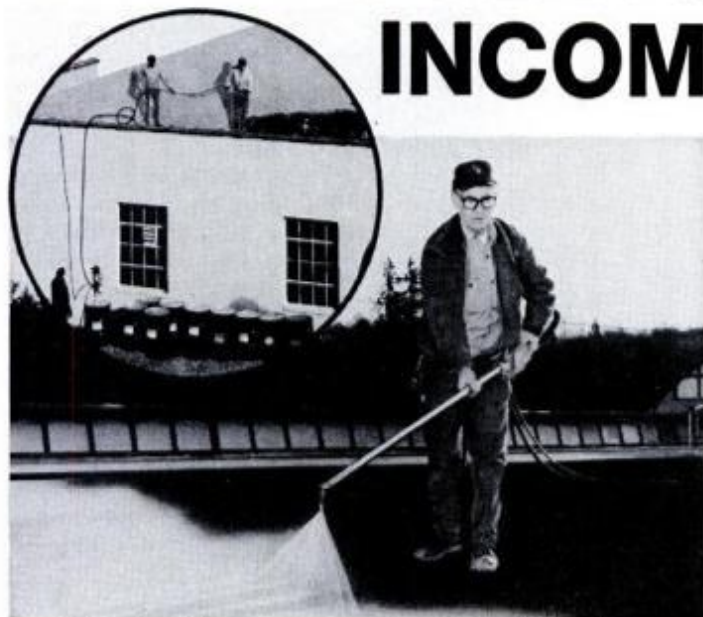
(Please turn to page 228)

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SUPERPHONE

(Continued from page 226)

whether the person you're talking to is telling the truth? A number of people now believe it can.

For just \$1500, Rick Bennett will sell you a Hagoth HS/2 Voice Analyzer. Attached to any telephone, it will give a direct readout of the degree of stress in your party's voice. It isn't limited to telephone, either—it also works on tape recordings, on radio and TV, and live.

The theory is that the stress a person has when lying causes an 8- to 14-Hz tremor in the voice. The device strips the voice signal of fundamentals, harmonics and volume changes, and checks what's left for the tell-tale tremor. Readout is a panel of eight red and eight green lights, which light in varying ratios. The more red lights, the more stress.

But voice stress doesn't always indicate lying, so it takes some skill to frame questions and analyze the readout. Bennett has worked with some of ex-President Richard Nixon's broadcast statements and with the 1976 Presidential debates. He's included his analyses in an \$8.75 paperback book about Hagoth.

Cutting the cord

I've come across two FM wireless telephones, Fracom's Rovaphone and the No Cord Phone from Allied Telecommunications. A box sits where the phone sat. The handset is a battery-powered FM transmitter. It looks just like a telephone with an antenna, but is completely portable. You can carry it around as you move from room to room, take it out to the patio or pool, or even to a near-neighbor's house. It will work over a distance of about 300 feet from the box, but that can be limited by steel-framed buildings, low batteries or CB interference.

These aren't radiotelephones like those in boats and cars. Pick up the receiver and you get a dial tone, and if a call comes in, the phone beeps. Think of it as just another extension phone, but one without wires. Retail prices are about \$400 for the Allied unit, \$380 for the Rovaphone with rotary dial, and \$420 for a pushbutton Rovaphone. Rovaphone also plans to introduce a more powerful, belt-clip model, primarily for industrial use.

Add-ons built in

ITT, the second-largest telephone manufacturer in the world, has introduced a number of new phones to be sold in retail stores for do-it-yourself installation. One includes a recorder,

(please turn to page 230)



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SUPERPHONE

(continued from page 228)

another an alarm clock, a third, a radio. A useful device for the infirm or insecure is ITT's Security Phone with one-button dialing of police, fire department and other emergency numbers, as well as a conventional pushbutton keypad. Prices for these phones range from \$35 to \$300, and a 72-station service network is being set up.

Other single-unit superphones are Figure-phone, which packs a calculator, clock and automatic redialer for about \$270, and Hammacher Schlemmer's Marketline phone which, linked to a market information service, will tell you what's happening with more than 7000 stocks; it's about \$500.

Don't overlook Ma Bell, either. She offers lots of goodies, some for outright purchase, some for monthly charges. These include high-style phones and speakerphones, as well as accessories like volume control, privacy switch to exclude extensions and automatic dialers. In some exchanges you can get services that kick an incoming call from a busy line to another number in your home, automatically forward your calls to another number, let you know you have an incoming call waiting and permit conference calls. Call your local phone company business office for information about these devices and services.

What we've seen so far is really just the beginning. New legislation, rising phone rates and microprocessor technology will produce a flood of gadgets in the near future. Stay close by your phone for further developments. **PM**

Telephone and accessory sources

Super Electronics (Soft Touch), Box 230, 80 Border St., East Boston, Mass. 02128. **Radio Shack**—check phone book for local store. **Phone City, Inc.**, 1152 Avenue of the Americas, New York, N.Y. 10036. **Elco Electronic Instrument Co.**, 108 New South Rd., Hicksville, N.Y. 11801. **DataLink Corp.** (cradle lock), Box 1145, 1282 Fayette St., El Cajon, Calif. 92022. **Zoom Telephonics** (The Silencer), 65 Franklin St., Boston, Mass. 02110. **Triamix Corp.** (Stereo-phone), 336 Old Hook Rd., Westwood, N.J. 07675. **Vinman's** (Sound Switch), 29 East Madison St., Suite 1103, Chicago, Ill. 60602. **Touchables, Inc.**, 222 West Ontario St., Chicago, Ill. 60610. **Floyd Bell Associates** (Bel-Ringer), 1333 Chesapeake Ave., Columbus, Ohio 43212. **Modern Electrical Concepts, Inc.** (Liberty Light), 3601 Hempstead Tpke., Suite 203, Levittown, N.Y. 11756. **Utility Verification Corp.** (Tele Coster and Computer Phone), 66 Commack Rd., Commack, N.Y. 11725. **Telefreeze Corp.**, 200 Park Ave., New York, N.Y. 10017. **Hagath Corp.**, 12350 206th Pl. S.E., Issaquah, Wash. 98027. **Fracom/Rovaphone Corp.**, 2130 West Clybourn, Milwaukee, Wis. 53233. **Allied Telecommunications Equipment Corp.** (No Cord Phone), 18 East 41st St., New York, N.Y. 10017. **ITT Corp.**, 320 Park Ave., New York, N.Y. 10022. **Phone Devices Corp.** (Figure-phone), 624 South Michigan Ave., Chicago, Ill. 60605. **Hammacher-Schlemmer Co.** (Marketline phone), 147 East 57th St., New York, N.Y. 10022.

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Carbon	X	X		X	X
Cast Iron	X	X			X
Composites	X	X	X		X
Composition Board			X	X	X
Fiberglass	X	X	X	X	X
Foamed Glass	X	X			X
Friction Materials	X	X	X	X	X
Glass	X	X			X
Hardened Steel	X	X			X
Honeycomb Materials					X
Marble, Natural	X	X	X		X
Marble, Synthetic	X	X	X	X	X
Plaster			X	X	
Plastic Laminates	X	X	X	X	X
Plywood			X	X	X
Stainless Steel	X	X	X		X
Stranded Cable	X	X			X
Superalloys, Iron-base	X	X			X
Superalloys, Nickel-base	X	X			X
Tempered Hardboard			X	X	X
Tires, Steel-reinforced					X
Titanium	X	X			X
Tile, Ceramic	X	X	X		X

*Requires coolant and variable - speed machine

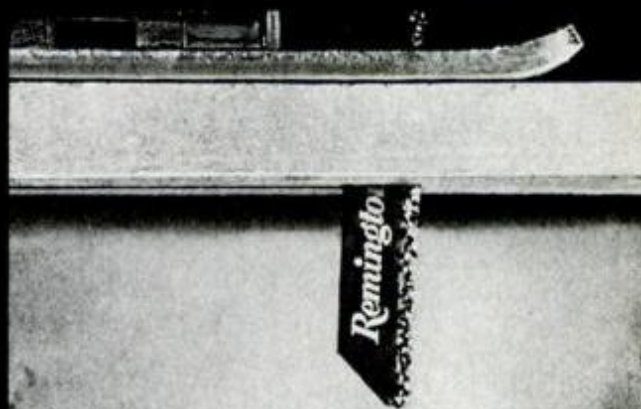


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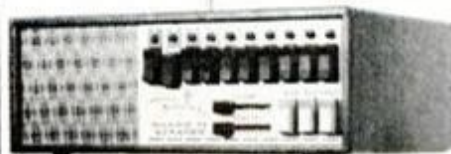
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(Continued from page 6)

LETTERS

Bus, page 70, Jan. '78). I think it was extremely well done, very informative and quite interesting.

Your comments concerning our association have resulted in our office being deluged with mail. Needless to say, we love it.

MAX D. TODD

FAMILY MOTOR COACH ASSN.

CINCINNATI, OHIO

Warning to motorized bikers

With reference to the article, *How to Motorize Your Bicycle* (page 112, Dec. '77), I wish to point out that a front-fork-mounted, gas-driven motor can be extremely dangerous. As a youngster, I was nearly killed while driving a similar motor-driven bicycle. The tiny nut and bolt holding the front fender to the top of the front fork vibrated loose, allowing the fender to jam between the driving roller and tire, instantly stopping the front wheel.

I was tossed over the handlebars and wound up with broken teeth, a broken jaw and a brain concussion. I would suggest that the front fenders be removed from bicycles using this type of roller-propelled driving device.

LLOYD P. BENJAMIN

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Author Bill Hartford replies: "The engine is designed so it does not interfere with the brakes or fender. The fender, of course, is a mudguard, so many operators will want to keep it on their bikes. Lock washers should be used. In addition, the operator should always check fenders and other components that could obstruct the free movement of the front wheel."

Kind words from the crew

I read with great interest and pride your article about the rescue of downed airmen by the *USS Barb* (*Rescue from the Heart of a Typhoon*, page 73, Dec. '77). The article, like the issue in general, was outstanding and widely read by the crew of the *Barb*.

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2 TO 5 INCHES IN JUST 3 DAYS—OR LESS
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Startling discovery—The Astro-Trimmer has got to be the most sensationally effective and the most fun to use slenderizer of all time. It is a marvel of ease, comfort and efficiency—and a pure joy to use. The Astro-Trimmer's totally unique design consists of a double layered belt; a soft nonporous inner thermal liner which wraps completely around your mid-section producing a marvelous feeling of warmth and support—and a sturdy outer belt that attaches you to the super duo-stretch Astro-Bands which you hook to any convenient doorway. These duo-stretch bands enhance your slightest movements and transmit their effect—greatly magnified—directly to the inner thermal liner of the belt to produce an absolutely unequalled inch-reducing effect. In fact, for sheer inch loss, the Astro-Trimmer is supreme. Try it for yourself—at our risk—just slip on the belt, hook it up, stretch and perform one of the easy-to-do movements in the instruction booklet and watch the inches roll off. Men and women from 17 to 70 are achieving sensational results from this ultimate inch-reducer.

How many excess inches can I lose with the Astro-Trimmer? How many excess inches do you have? Many users lose 2 or more inches from their waists and 2 or more inches from their abdomens the very first day. Three, four, even more inches off the waist in three days is not uncommon. Not everyone will do this. The degree of inch loss will vary with individual body response. However, this matchless body shaper melts excess inches off the waist, abdomen, hips and thighs with such amazing speed that if your waistline isn't 2 to 5 inches trimmer after using your Astro-Trimmer for just 3 days—or less—and if you don't lose these inches without dieting and in only 5 to 10 minutes a day, you may simply return your Astro-Trimmer and your money will be refunded.

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Bill Parker
BEFORE

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Portable Refrigeration breakthrough makes Ice chests Obsolete!

*New Solid State Refrigeration Modules
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Your ice chest is bulky, awkward to carry, messy and inefficient at keeping its contents cold. You have to buy ice every day, if you can find it, throw away the spoiled soggy food and drain off the water repeatedly.

Conventional portable refrigerators are either too heavy, too noisy, drain your battery too quickly or need to be kept level.

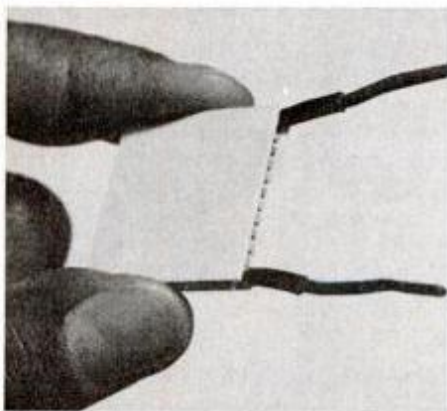
These problems and inconveniences have finally been resolved in one totally new product - the Frostpak 12 volt portable electronic refrigerator. We believe the Frostpak represents such a dramatic advance in refrigeration for recreational use that all existing methods are now outmoded.

USES AEROSPACE REFRIGERATION MODULES

The Frostpak cools your food electronically with solid state thermoelectric refrigeration modules. These same powerful modules are used by military and aerospace scientists to cool critical components in rockets and satellites. They use thermoelectric cooling because of its absolute reliability, insensitivity to motion or level, small size & weight and minimal battery drain. Only the Frostpak has these outstanding features.

WHY IS THE FROSTPAK SO MUCH BETTER THAN AN ICE CHEST?

An ice chest maintains an air temperature of 50-60 deg. F. Meat and milk spoil rapidly at temperatures above 50 deg. F. which is why the top of your meat will go bad even when it is sitting on ice. The Frostpak maintains normal home refrigeration temperatures of 40-45 deg. F. even in 95 deg. F. weather. You can also keep food frozen in air temperatures up to 80 deg. F.



Two of these miniaturized thermoelectric modules replace all the bulky complex piping coils, compressors and motors in conventional portable refrigerators. The modules pump heat from your food into efficient heat sinks where it is dissipated by a quiet fan. They operate on a principal called the "Peltier Effect" - passing electricity through the junction of dissimilar metals causes heat to flow from one metal to the other.



The new Frostpak keeps 40 lbs. of food at household refrigeration temperature but weighs only 15 lbs. Only 21" x 16" X 16" ext.

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Fits into virtually any boat, van or camper. Carry it on the back seat during car trips. Ideal for fishing and hunting - bring your catch back home fresh (a few loads of fish fillets could pay for your Frostpak). Use it for grocery shopping, medicines, carrying film, salesmen's samples. Take it to the drive-in movies, auto races and other sporting events. With an inexpensive battery charger you can use your Frostpak as a bar fridge all winter and a patio fridge in the summer. Run it in your motel room at night and enjoy a midnight snack whenever you feel like it. We have customers using Frostpaks on construction sites, in workboats, laboratories and even in locker rooms for a "cold one" after the game. Even sailboats with no engine can enjoy refrigeration if they have dock power to recharge with.



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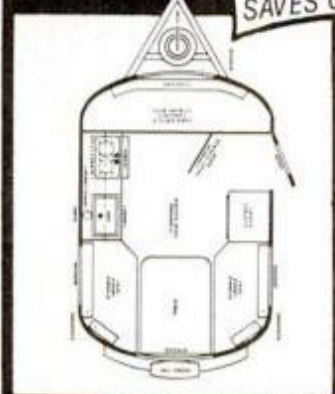
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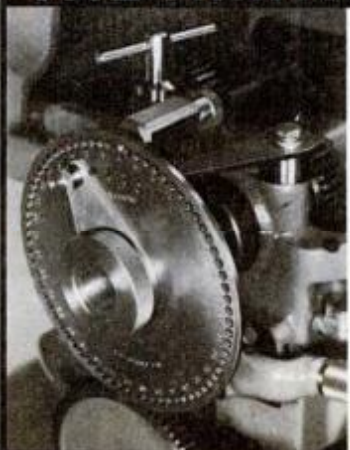
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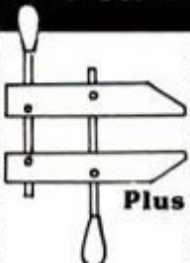
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Footed cabinet uses antique brass hinges and has convenient brass carrying handle. Kit includes pre-cut wood parts, door glass, all hardware, hinges, sandpaper, glue and complete assembly instructions. 10½" high x 8½" wide x 4" deep, with door that swings completely open for easy access to optional Swiss works. Save money and order Kit complete with "Lifetime" Thorens Swiss movement and 5 Swiss starter discs of 5 lovely melodies for as little as \$89.95.



DELUXE MODEL

Cabinet Kit **\$59⁹⁵**
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Deluxe footed cabinet features delicately etched glass door, "coach" style brass handle and four gracefully turned columns in your choice of three select cabinet woods. Kit includes everything you need. 10½" high x 10½" wide x 5½" deep, with hinged door for easy access to optional Swiss works. Save money and order Kit complete with 30-note Thorens Swiss movement and 5 Swiss starter discs of 5 lovely melodies for as little as \$119.95.

Build a family heirloom that can last for generations. You make it to order. Choose Cabinet Kit in Standard or Deluxe Model, in your choice of walnut, cherry or pine. Both Kits include pre-cut, mitred, easy-to-assemble parts with simple assembly guides. Optional 30-note disc mechanism is imported from Switzerland, made by the famous Thorens music craftsmen, and comes with five music discs featuring charming traditional tunes.

Purchase Swiss Movement and music discs with your Kit now and save \$10. Movement also available separately. All items postage-paid with this order.



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710392
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710343
- ☐ Solid Cherry \$34.95
710350
- ☐ Solid Pine \$29.95
710368

DELUXE CABINET KIT

With Movement:

- ☐ Solid Walnut \$129.95
714345
- ☐ Solid Cherry \$124.95
714352
- ☐ Solid Pine \$119.95
714360

Cabinet Kit alone

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714378
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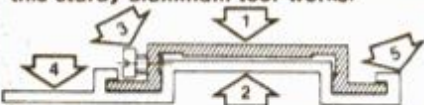
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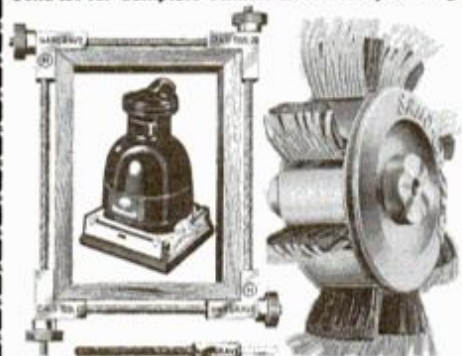


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1000-A3 Unimat 5-in-1 Shop\$199.98

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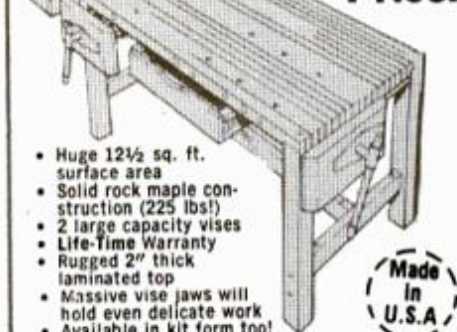
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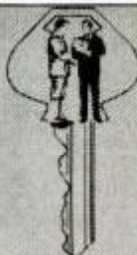
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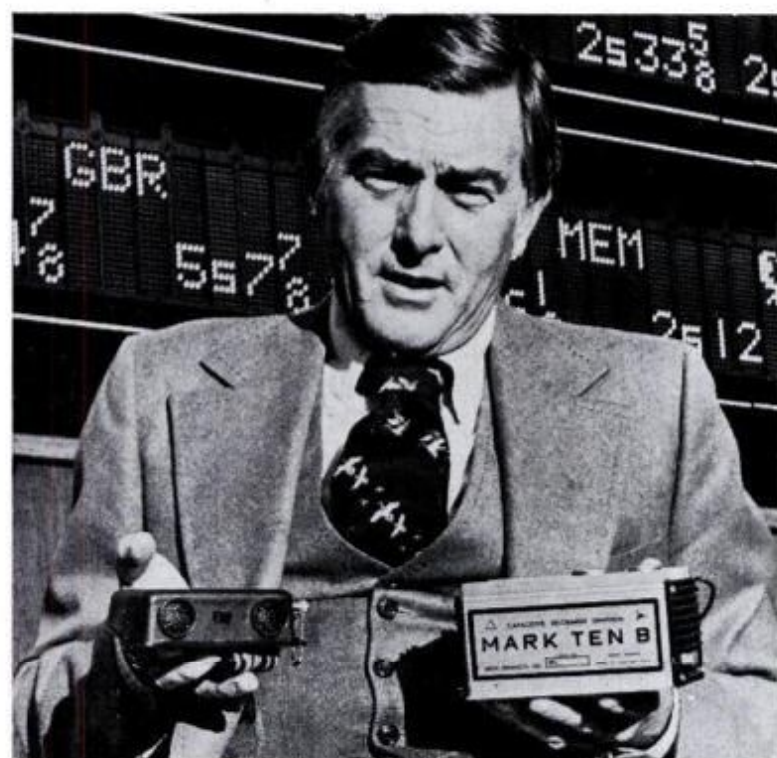
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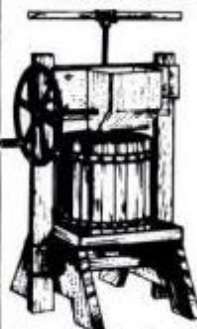
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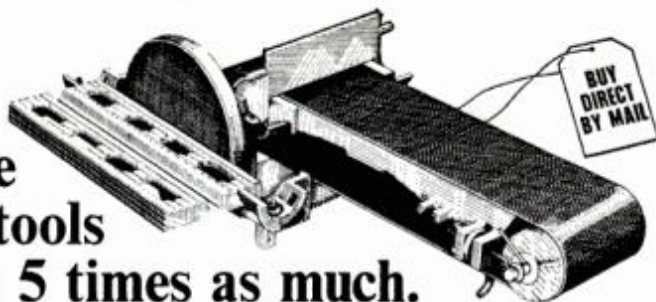
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Printer Break-through



A new 10-digit display calculator with the world's first dual-element integrated printing head will revolutionize the printing calculator.

The full-featured \$89.95 Canon P10-D with its one-year parts and labor limited warranty is the greatest printer value ever offered by JS&A.

Hats off to IBM. Their single-element typing system did away with typewriter keys and started a new technology.

The new Canon P10-D printing calculator starts another new technology. Their dual-element printing system does away with the standard printing head which required a separate disc for each column. The Canon has only two discs—one with digits and the other with symbols.

The P10-D head weighs only ½ ounce compared to 31 ounces in a typical printing head. Its motor weighs only nine ounces—again much less than the heavier conventional motors required to drive larger heads. The Canon motor is smaller, lighter and more efficient because it moves less weight.

THE MOST EFFICIENT SYSTEM

The printing head is controlled by an LSI (large scale integrated circuit). As you press a key, a pulse is generated from this circuit and sent to the motor which does two things: 1) positions the two discs to print the numbers or symbols and 2) glides the numeric disc across the ten column width of the paper.

Conventional printers print from metal discs through thick fabric ribbon onto paper. The Canon system prints directly on paper so each impression is sharp, clear and easy to read. The synthetic polymer disc is first inked by a special cartridge before it prints. Each ink cartridge is easily replaceable. The cartridge lasts for more than 15 rolls of paper at a cost of 17¢ per roll—far less than any other system.

PLAIN PAPER PLUS

Using standard paper tape is only one of several advantages that make the Canon a truly spectacular value. Here are some other exciting new features:

Dual Power Operate the Canon from either your AC outlet or its built-in rechargeable batteries. It's totally portable, yet it also makes a handsome desk calculator.

Dual Display Just flip a switch and the 10-digit large green fluorescent display can be used with or without the printer.

Space-Age Styling Compare the sleek appearance of the Canon with any other printer. It's small enough to fit in your briefcase and large enough to use as a space-saving desk unit. It measures only 1¾" x 4¼" x 8½", weighs only 24 ounces and the paper tucks into the body of the unit—perfect for travel.

Buffered Keyboard If you enter your prob-

lems faster than the printer can print them out, don't worry. The unit's memory stores your keystrokes and prints them out in rapid succession.

We have always looked at small printers as gimmicks—calculators that lack many important features. We were surprised with the Canon. It has features that far exceed most printers costing hundreds of dollars more.

The following is a list of those features: 10 digit capacity • full four-key memory • addition, subtraction, multiplication and division • percentage key • add-on and discount calculations • power and reciprocal calculations • repeat calculations • add-mode • switch for full-floating or second and third fixed decimal positions • round off or round down switch • paper tape advance.

There are other convenient features that make it perfect for people who spend hours at their calculators. There's a three-digit item counter that counts and prints out the number of entries while printing your total. The symbols on the right side of the tape tell you the nature of each entry. Even in its battery

operated position, you could print out more than half a roll of tape before the unit signals you that its batteries are low.

A NEW WAY TO BUY

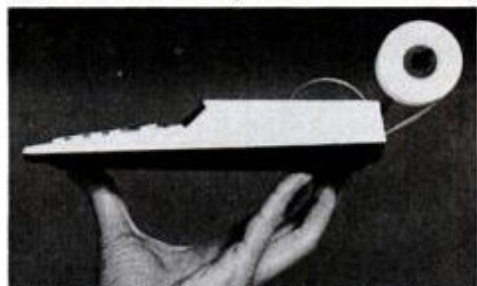
JS&A offers you a new way to buy your 10-digit Canon P10-D. First we give you the opportunity to use one for 30 days. Carry it in your briefcase. Put it on your desk and see how handy it becomes and how little space it takes up. Check the paper tape and see how clear and easy-to-read it is. Bring it home and let the whole family use it.

Then, within 30 days, decide. If the Canon is not perfect for you, return it for a prompt and courteous refund. And if you do return it, not only will we still consider you one of our good customers, but we will also refund your \$2.50 postage, let you keep the paper tape, and thank you for giving us the opportunity of showing it to you. We couldn't be more positive about the quality and value of this incredible new product.

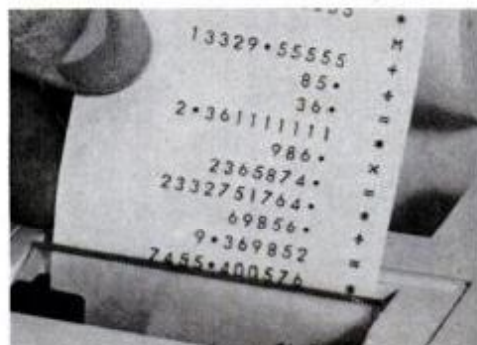
JS&A is America's largest single source of space-age products. We have been in business for over a decade—further assurance that your modest investment is well protected. Canon is one of the world's largest manufacturers of cameras and precision quality instruments and is highly respected as a quality manufacturer of electronic products.

The Canon costs only \$89.95 plus \$2.50 for postage and handling and includes a free roll of tape, one ink cartridge, rechargeable batteries and a power cord/charger. It's an incredible value thanks to its new technology. To order, send your check to the address below (Illinois residents add 5% sales tax) or credit card buyers may call our toll-free number.

Space-age technology has produced another major product breakthrough. Order your Canon P10-D at no obligation today.



The sleek appearance of the Canon P10-D makes it a handsome addition to any desk.



The direct-impression dual discs print cleaner and sharper on conventional paper tape.

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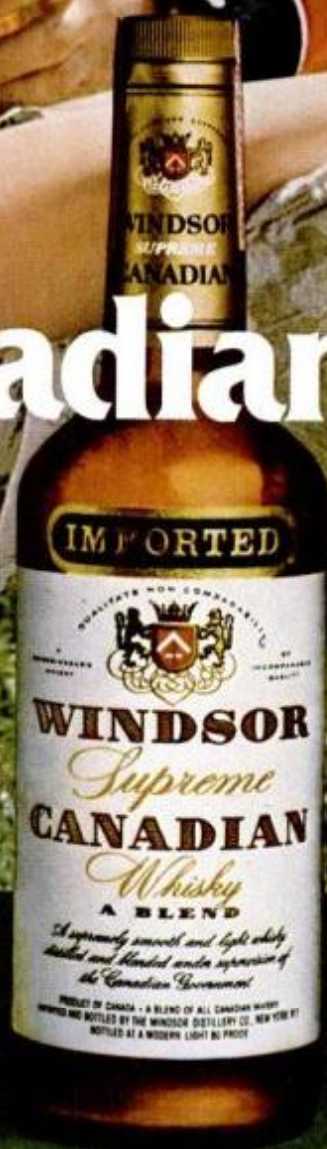
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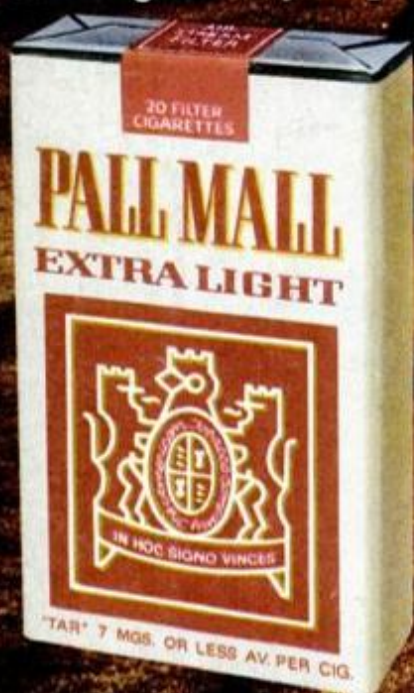
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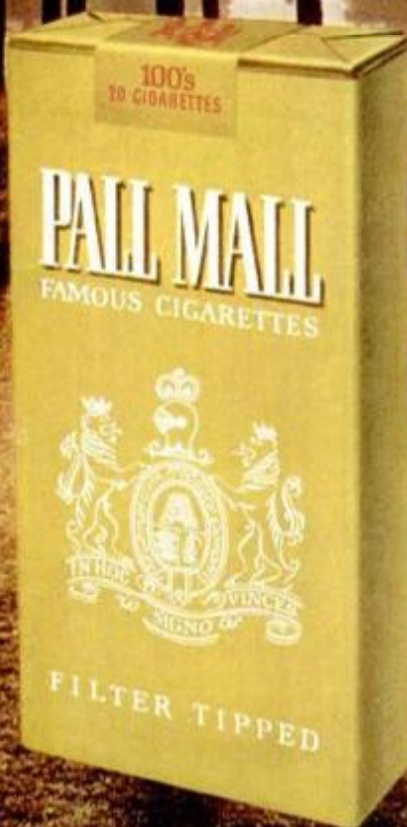
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